Heating Piping & Air Conditioning

FEBRUARY 1959

Single copy price 75c

. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

Engineering Approach Essential To Good Air Pollution Control

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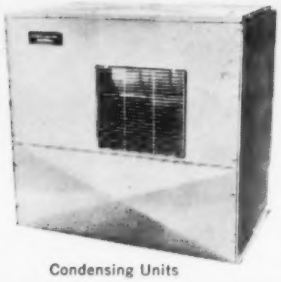
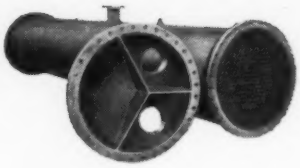


Condensing Units

Packaged Air Conditioners



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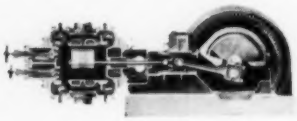
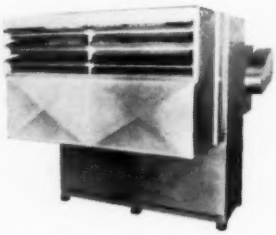
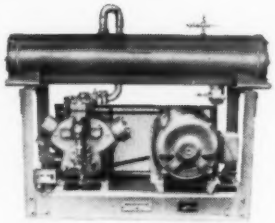


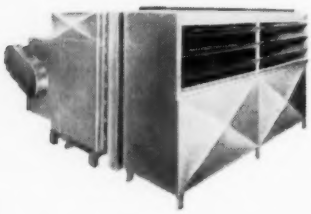
Horizontal Ammonia Compressors



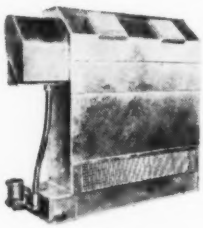
Remote Packaged Air Conditioners



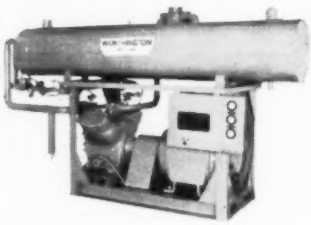
Refrigerant 12 and 22 Condensing Units



Central Station Air Handling Units



Evaporative Condensers



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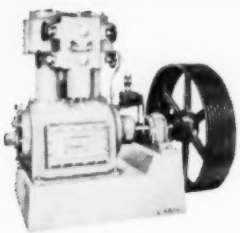

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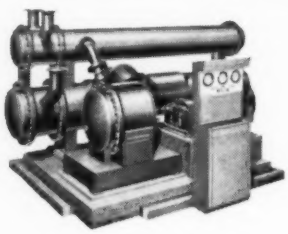
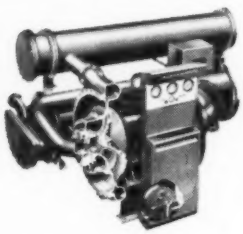


Centrifugal Refrigeration Systems



Hermetic Centrifugal Refrigeration Systems

In air conditioning...in refrigeration

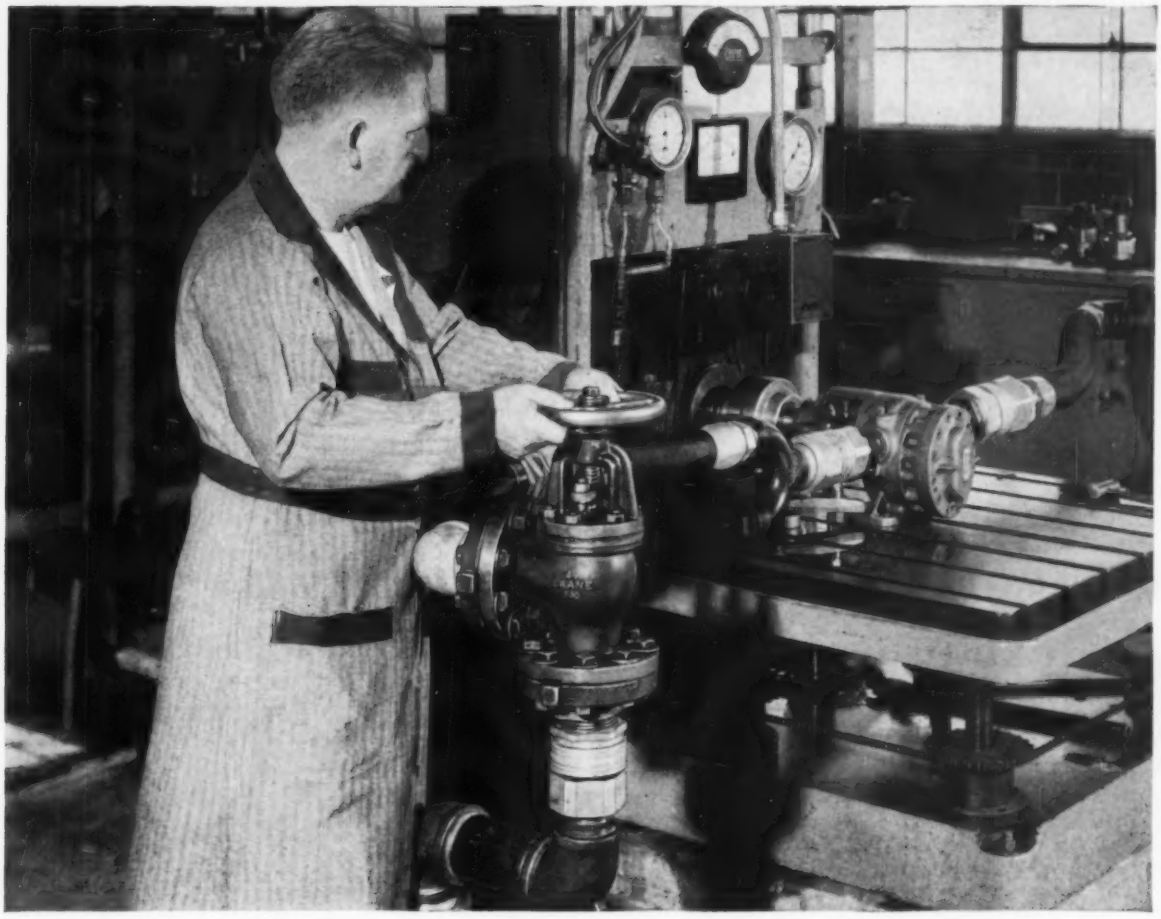
Worthington line means complete line

Over 70 years of fine engineering know-how and equipment design add up to recognized Worthington leadership in the air conditioning and refrigeration field. A truly *complete* line includes both packaged and central station units for all air conditioning and refrigeration needs. A nationwide organization of distributors ready and able to give you total sales and engineering service, assures you impartial and competent recommendations on the exact system you need.

We would be delighted to consult with you, your architects, contractors, and engineers on *any* air conditioning or refrigeration problems. Offices and representatives in major cities. For more information write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section 12-13, Ampere Station, East Orange, N. J. In Canada, Worthington (Canada) Ltd., Brantford, Ontario.

WORTHINGTON

Roper Hydraulics, Inc. Experiences CRANE Quality



Uses CRANE valve on severe throttling for 23 years—without repairs

Twenty-three years ago, Roper Hydraulics, Inc., Rockford, Ill., installed this Crane 2½-inch, 300-pound bronze plug disc angle valve for throttling service on a 300- to 400-pound pump test line. Since then, testing has been done at pressures up to 1000 pounds without valve failure.

Altogether, this Crane valve has been operated intermittently on an average of 30 hours weekly for 23 years! Only recently was it necessary to replace some of its working parts. Here is demonstrated proof that Crane quality is really the durable kind purchasing agents seek . . . the dependable kind that engineers and plant operating people want.

In valves and fittings for every service, Crane quality gives greater assurance of value—it's today's most reliable price tag. And on all your piping equipment needs, you can get prompt delivery through your local Crane branch or wholesaler.

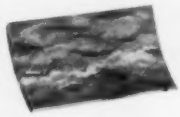
IDEAS FOR YOU in the 36-page booklet "Valve Performance Facts." Ask your Crane Man for a copy, or write to the address below.

CRANE® VALVES & FITTINGS

PIPE • PLUMBING • HEATING • AIR CONDITIONING

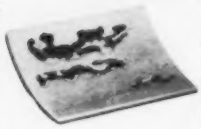
Since 1855—Crane Co., General Offices: Chicago 5, Ill.—Branches and Wholesalers Serving All Areas

With no lining at all



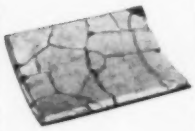
Unlined steel heaters are subject to corrosion even under normal service.

With plastic lining



There is no known plastic or phenolic lining that will withstand temperatures required for hot water service.

With ordinary concrete lining



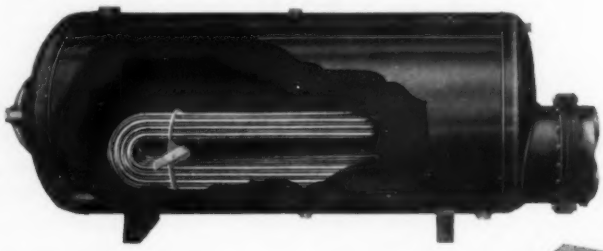
Plain steel plates soon lose protection, due to cracking and chipping. Cracks create localized corrosive cell spots.

SPECIFY the only cement lining made exclusively for Storage Water Heaters...

P-K PRE-KRETE®

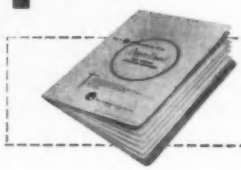
Every cement-lined storage water heater bearing the P-K name-plate is factory-lined with Pre-Krete. Pre-Krete is completely uniform, without weak spots or "holidays," because it is thoroughly blended in special P-K equipment. It forms a strong, durable coating, ¾" thick, that prevents rust and corrosion, and provides high resistance to thermal shock. Pre-Krete will not chip, crack, or flake even at temperatures up to 900°F.

You get a comprehensive guarantee on every P-K Storage Water Heater



Every P-K Pre-Krete Lined Storage Water Heater is fully lined including manhole, cover plate and heating element nozzle.

Specify P-K Pre-Krete lined and you get a storage water heater on which all materials and workmanship are fully guaranteed to be first-class in every respect, and you have the P-K assurance that every heater bearing its name will heat its rated capacity of water. For full details, write for your copy of Catalog Number 19 to Patterson-Kelley, 2102 Linton Street, East Stroudsburg, Pennsylvania.



2

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Heating Piping & Air Conditioning

Vol. 31, No. 2

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FRONT COVER: Smoke emitted from experimental meteorological tower at Brookhaven National Laboratory, New York, shows triple smoke trails during temperature inversions. Photo shows relatively common change of about 20 deg in the angle of wind direction from bottom to top of tower.

Why Every Steam Heated Unit Needs its Own Steam Trap

. . . the theory, practice and proof of "unit trapping" for top temperatures

Using an individual trap for each steam heated unit, including each separate coil, chest or chamber of a machine—pays off for the user. Here are just two examples:

1. On a creamery dryer

Drainage Method	*Air Temperature*
Restricted Blow-thru	250°
Group trapping (1 trap for 8 coils)	225°
Armstrong Unit Trapping (8 traps—1 for each coil)	**309°**

2. On a platen press

Drainage Method	*Processing Time*
Restricted Blow-thru	50 minutes
Group Trapping	35 minutes
Armstrong Unit Trapping	**25 minutes**

Why Unit Trapping Works Best

It is reasonable to assume that no two steam heated units will have *identical* condensing rates. Even the slightest difference in rate will cause a difference in steam pressure drops through the units. Here's where the trouble starts. Condensate from each unit may flow to the trap. But, what about air and other non-condensibles in the system? A difference in pressure drops too small to be indicated by an ordinary pressure gauge will permit backflow of steam from the higher pressure units to the lower pressure units. This backflow of steam may even impede flow of condensate from the trap . . . and it will definitely impede or block off flow of air to the trap. The result is sluggish heating, reduced temperatures, reduced output, fuel waste and increased possibility of corrosion. Figures 1, 2 and 3 diagram the action.

Unit Trapping Not Costly

No engineer wants any more mechanical devices in his plant than are absolutely necessary. But, the moderate additional cost of using two or more small traps, instead of one big one, is saved over and over again in improved efficiency.

If the traps are Armstrong, maintenance is no problem. And users frequently tell us that Armstrong traps outlast others two and three to one.

Steam traps usually represent a fraction of 1% of the cost of the equipment they drain. Does it make good sense to lose 10% or more of equipment capacity to save a few dollars on traps?

Why not test Armstrong unit trapping in your plant. If you are not completely satisfied with the results you can return the traps for a full refund of the purchase price. There is little to lose—lots to gain. Call your local Armstrong Factory Representative or Distributor, or write **Armstrong Machine Works, 8745 Maple St., Three Rivers, Mich.**

ASK FOR the 44-page Steam Trap Book and reprint of article on Unit Trapping.

801ST

ARMSTRONG STEAM TRAPS

How Different Condensing Rates Can Slow Production

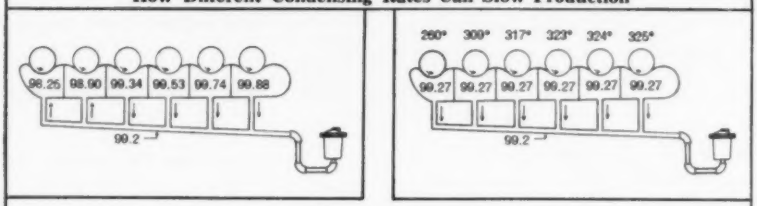


Fig. 1 This is a 6-roll ironer shortly after it has begun operating on 100 psi steam. When cold, wet material passes over chest 1, steam condensing rate is high and pressure drops accordingly. The pressure drop in chest 2 will not be as great, and so on down the machine as the material becomes progressively hotter and drier. Average pressure in the chests then is 99.27 lbs., and drain header pressure is slightly less, about 99.2 lbs. Under these conditions, steam from drain header enters chests 1 and 2 (as indicated by arrows at side of drain lines) because of pressure difference. Though condensate from chests drains by gravity, air can't leave chests countercurrent to incoming steam. Fig. 2 shows what happens next.

Fig. 2 This is the same 6-roll ironer after it has been operating a while. Air has accumulated in chests 1 and 2, reducing condensing rate and decreasing pressure drop. This process repeats itself down the line until pressures are as shown—that is, enough air will accumulate in each chest so that condensing rates and pressure drops of all chests will be about equal. The net result is shown in chest temperatures which are actual pyrometer readings taken on a 6-roll ironer, drained by a master trap, in a Chicago laundry. The laundry was making 337.9°F steam, but getting an average of only 309.6°F from the ironing surfaces, necessitating slow operation and frequent reruns. Then they tried Armstrong unit trapping—see Fig 3.

How Unit Trapping Prevents Trouble

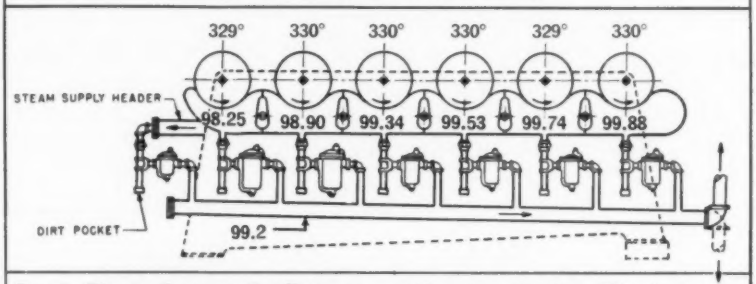
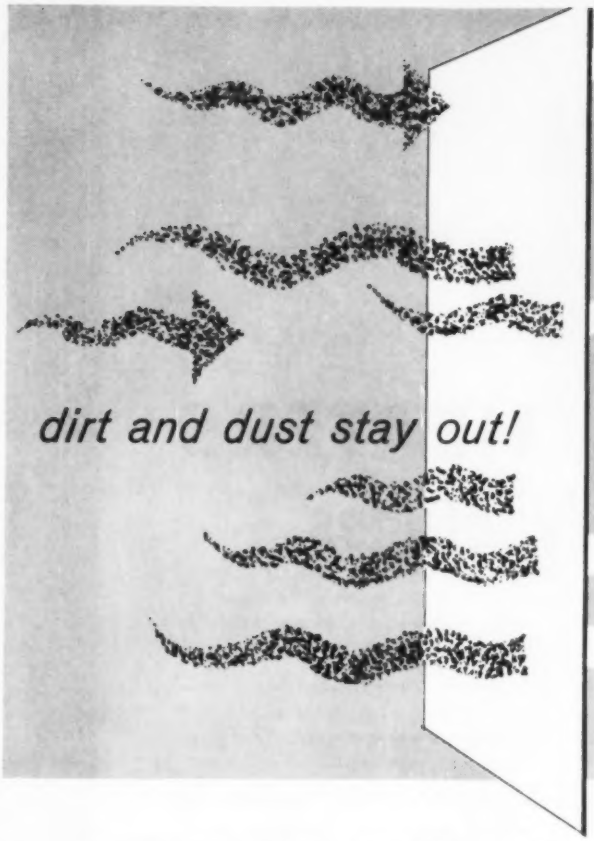
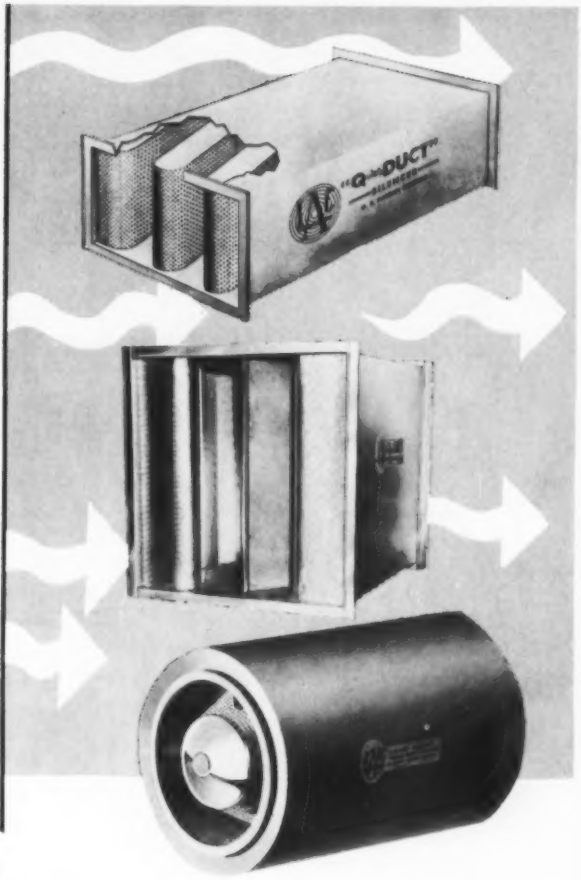


Fig. 3 This is the same 6-roll ironer, now unit trapped. Temperatures shown are also actual pyrometer readings—the average of 329.6°F is 20° higher than with group trapping. This is because air is continually removed from each chest into the drain header, and cannot get back into any chest.





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Fewer Wing Heaters Needed The old concept of unit heaters spaced every 60 or 80 feet doesn't apply with Wing. Wing's largest Revolving Heater, for example, covers over 125′ x 125′.

In a large building this means fewer heaters, much lower installation and maintenance costs. In a building 125′ x 420′, for instance, 4 Wing Revolving Heaters do the job of 12 stationary heaters–without uncomfortable hot blasts or cold spots.

60 Foot Ceilings, And Higher Many thousands of high ceiling Wing Revolving Heaters have been installed where efficiency and comfortable heat are paramount.

Equally Effective with Low Ceilings Wing's line of adjustable discharge outlets provides efficient heating regardless of ceiling height.

Low Outlet Temperature Because of Wing's exclusive heating section design, low pressure heating comfort can be obtained with any steam pressure up to 200 psi.

For complete detailed information on Wing's line of Revolving Unit Heaters contact your local Wing Representative or write our Main Office in Linden, N. J.

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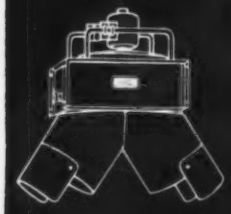
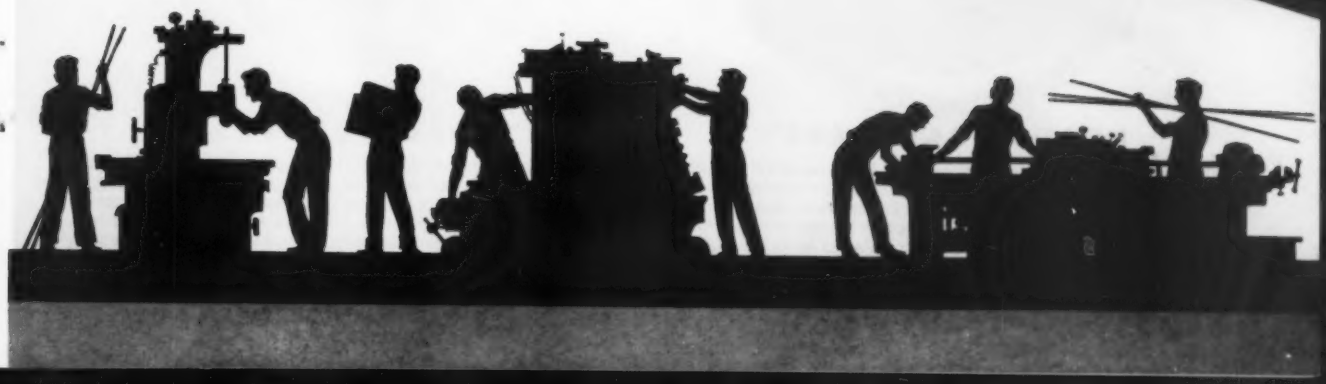
10 FEET TO 27 FEET



12 FEET TO 60 FEET



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If you're aiming for complete satisfaction—yours and your customers—when you install packaged cooling towers, just set your sights on the Marley line for '59. In the wide variety of sizes, styles and structural materials that Marley makes available, you're sure to find a tower that just hits the mark for any cooling requirement. Forced draft, induced draft, natural draft—steel, wood, asbestos cement board casings—you can call your own shots when you specify Marley.

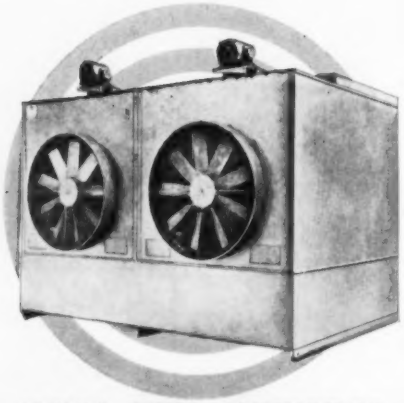
Of equal importance, you receive double-barreled support on every cooling job. Your Marley distributor has been carefully selected for his ability and eagerness to serve you both before and after your purchase of any Marley product. Back of him stands The Marley Company's assurance that every product will be satisfactory to every purchaser—a guarantee fulfilled for 36 years.

That's why we say you can't miss with the Marley line for '59. Look it over . . . then get in touch with your local Marley distributor!

MARLEY

The Marley Company

Kansas City, Missouri



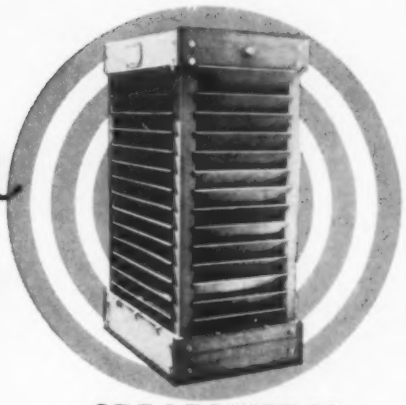
DUAL AQUATOWERS®

DUAL AQUATOWERS® (Models 4342, 4352 & 4362), the latest additions to the complete line of Marley Aquatowers, expand capacities of the line up to 120 tons, nominal. Each model has dual fans, dual hot water basins and dual cooling chambers mounted on a common basin. They are especially applicable for "sensitive" cold water temperature applications. Hot dip galvanized finish.

AQUATOWERS®

AQUATOWERS® (Models 4205 thru 4210) for services from 5 to 10 tons, nominal, feature recessed fan venturis and covered hot water basins. Their attractive "appliance-like" design makes them especially applicable where appearance is a factor. Like other Aquatowers, they are hot dip galvanized, have close-packed fill, diffusion decks, drift-eliminators and heavy duty mechanical equipment.

set your sights on a Cooling Tower

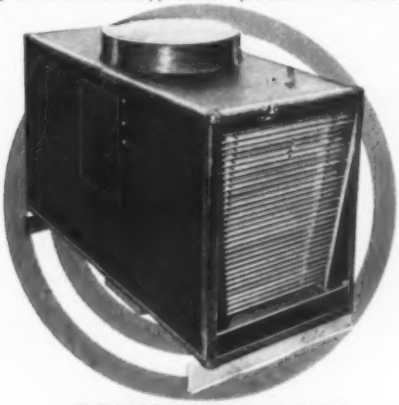


SPRATOWERS®

SPRATOWERS® of natural draft design provide maximum economy with consistent high performance. Spray nozzles of non-clog design developed scientifically by Marley produce maximum water break-up with highest water cooling efficiency. Structure is extra-sturdy, rugged columns are double-bolted. SpraTowers are available in capacities from 3 tons up—models up to 15 tons are supplied with pre-assembled basins.

AQUACOOLERS®

AQUACOOLERS® feature full capacity performance and leak-proof, whisper-quiet operation—all in minimum installed plan area. Casings, basins and centrifugal blowers are hot dip galvanized. Marley nozzles and wood filling provide maximum water break-up and air-water contact. Capacities range from 5 to 50 tons, nominal. Smaller models ship completely assembled; larger in 2 sub-assemblies.

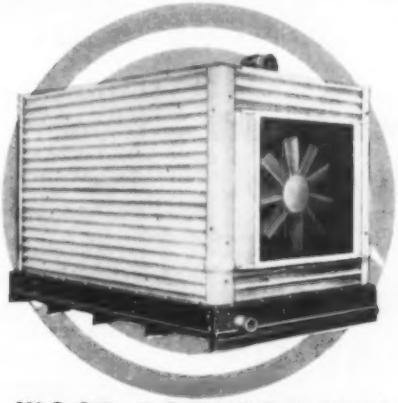


PERMATOWERS®

PERMATOWERS® set a new standard of cooling tower durability through liberal use of inert materials impervious to corrosive conditions. Vertical air discharge, quiet operation, and immunity to corrosion permit their use in any location, any climate. Available in capacities ranging from 5 to 75 tons, nominal. Permatowers offer all the Double-Flow® design advantages of performance, simplicity and permanence.

AQUATOWERS®

AQUATOWERS® (Models 4315 thru 4360) assure long, trouble-free service, top performance, and greatest economy in services from 15-60 tons, nominal. Packaged construction permits easy installation; clamp-down design permits easy disassembly. Rugged heavy-duty construction and hot dip galvanized finish minimize corrosion and maintenance. The world's standard in this capacity range.



WOOD AQUATOWERS®

WOOD AQUATOWERS® are of forced draft design with vertical air discharge, hence, can be installed in confined areas often unsuitable for towers of different design. Structural materials—long life redwood framework, asbestos cement board casing and hot dip galvanized steel components—assure long life under corrosive conditions. 5 models available with nominal capacity of 20-50 tons.

They compared "K" factors and cost factors ...and bought SNAP*ON®

Here's how <u>you</u> can save installation costs on fittings — simply use Snap*On, the original one-piece pipe insulation molded of fine glass fibers. Nothing could be easier than insulating bends, valves and fittings with cut-and-mitered Snap*On — and you get a neat job, uniform in thickness.

On straight lines, too, no pipe insulation is so economical to apply as Snap*On — just spread the single seam and it snaps over pipe. In thermal efficiency Snap*On rates at the top of all general purpose pipe insulations on the market today. But make a cost comparison yourself by asking your G-B Snap*On distributor for a TEVA (Thermo-Economic Value Analysis) survey the next time you insulate piping. You'll find that for economy, for performance, for permanence, there is *nothing* like Snap*On!

FOR FREE TEVA SURVEY CALL YOUR LOCAL G-B SNAP*ON DISTRIBUTOR (LISTED IN YELLOW PAGES)

GUSTIN-BACON *Manufacturing Co* GUSTIN gb BACON

220 W. 10th St., Kansas City, Mo.

Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

LETTER FROM THE EDITOR

February 1959

Dear Reader:

I'm sure you'll find this February issue a helpful and an informative one. I'll try to highlight it here so that you can choose the articles and features of most importance to you.

You'll be interested, I'm sure, in the many answers to the question, "How Can Leak Be Detected Under Concrete Floor Slab?" (starting on page 94.) Several ways of detecting this type of leak are suggested. The method using radioactive substances in the hot water circulating in the coils received the most mention from readers answering this question. Other methods found to be successful include the use of dyes, fluorescent substances, sonic detectors, refrigerants, and changes in vapor transfer rates.

The new Boston Globe plant serves as an excellent installation to illustrate how a wide variety of heating, air conditioning, and ventilating requirements may be served by a well integrated arrangement of built-up systems. W. Joseph Stanley and Stanford E. Clock discuss the reasoning behind their decisions and show how a fan-coil perimeter system and an interior zoned system air condition the administrative and editorial offices. Details are also given on how newspaper production areas are heated, conditioned, and/or ventilated as necessary to compensate for heat producing equipment, exhaust ink mist thrown off by high speed presses and released from foundry melting pots, maintain proper humidity levels for paper storage, and perform a number of other functions. Their article starts on page 101.

Is solar energy or nuclear energy practical for providing space heating? George W. Rusler discusses this question in his article starting on page 106. He says solar energy could provide an excellent source within the next 10 or 20 years if it is actively exploited starting now. He believes that nuclear energy can possibly become a major source of usable power and energy only after several decades of effort in solving the major health problems, in plant development, and in building the new facilities required.

A laboring electronic computer generates a lot of heat -- so much so that facilities must be provided to remove it to insure against breakdown. Also, relative humidities must be maintained at exacting levels to prevent shrinking or stretching of recording tape that would affect the accuracy of the data being computed. Such an installation is in the new Bank of America building in Los Angeles and is discussed in an article on page 113 by Ivan F. Norcross.

Piping for the new Marineland of the Pacific is quite elaborate in order to keep the fish and mammals supplied with clean sea water properly filtered, heated, or cooled, and chemically treated as required by each display. The details of part of this system are discussed in an article starting on page 116 by J. Marx Ayres. Many unusual design features for handling sea water had to be included.

Odors and how to control them are subjects of growing importance to air conditioning engineers. It's a phase of air conditioning for comfort that should be better understood. "Round 2" of a series of seven articles entitled "Winning the Air Conditioning Odor Fight" is presented on page 119 by Albert B. Hubbard. This month he discusses measurement techniques from the quantitative detection viewpoint and last month he discussed disagreeable aromas from the qualitative detection viewpoint. His article starts on page 119.

This month's HPAC Data Sheet (pages 121 and 122) provides a quick method for determining the heating capacity for tempering ventilation air or for determining the air flow rate for removing a given quantity of heat from a building. The nomograph was developed by F. Caplan.

American Standards Association butt welding standards were revised late last year. Changes in B16.9 provide new safeguards against improper and inadequate marking of fittings and outline new recommendations for end preparation of fittings. The increasing interest in thin walled pipe is reflected in the new edition of B16.25 by separate listing of end preparation requirements for carbon alloy and ferritic alloy steels and for corrosion resistant materials. The new provisions also make the standard more realistic by modifying unwarranted tolerance or finish regulations. The author is H. H. George; his article starts on page 123.

We've heard a lot about the distant early warning (DEW) radar network along our northern border and how important it is in our national defense. How these stations are heated is discussed by Henry Vaugle, starting on page 130. Obviously, the problems of heating these structures are severe; temperature differentials up to 130 F with high winds are common. Failure of the heating system for even a short period would result in great discomfort and possible danger to the personnel. Because of the extreme difficulty of supplying fuel, another solution was found that combined the generation of electric power by diesel engines and use of the waste heat for space heating. A standby heat source is supplied by a package type, oil-fired hot water boiler.

Fan noise is an important problem in air conditioning applications where low noise levels must be maintained. The consulting engineer, when designing these systems, must consider many factors -- including sound pressure, energy content, blade frequency, and attenuation -- in order to come up with the best balance between system efficiency and quiet operation. W. E. Tracy reviews these factors in his article starting on page 136.

HPAC's Engineering Data File this month (pages 139 to 154) is on air pollution control. Many factors acting simultaneously determine whether dusts, fumes, gases, and vapors emitted to the atmosphere become an air pollution problem from the standpoint of annoyance or their effect on the health of individuals, or both. The extent of the problem in each area and the potential for growth of the problem determine the efficiency of the equipment that must be used to clean the effluents of industrial processes. Of course, the specific effluents involved must also be considered when designing and selecting control equipment. Knowledge of the effects of topography, meteorology, legal requirements, neighborhood requirements, and types of contaminants is needed.

Though I've run out of space, I at least want to mention some other things too -- for example, the variety of comments in the "Open for Discussion" pages (89 to 92) that have been contributed by readers. Also of interest will be the piping installation for the Navy's experimental jet catapults discussed on page 110. You'll also be interested in how the Detroit Edison Company air conditions their manholes to assure control of humidity conditions while repairing and installing cables -- this article is on page 128. Sam Lewis on page 135 and William Hurd Hillyer on page 138 have also contributed their regular features. Then the new section, "You'll Want to Know" consisting of short technical and business news items is on pages 29 to 34.

Bob Roose

Editor, HEATING, PIPING & AIR CONDITIONING

DRYNESS

best reason in the world for using

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SUPER-DRY REFRIGERANTS

"Genetron" Refrigerants are the ultimate in dryness. In "Genetron" 12, for example, there is less than one-thousandth of one percent of moisture! And the tight specifications for "Genetrons" are consistently *bettered* in production. That's why smart service engineers everywhere are insisting on Super-Dry "Genetrons."

Service? No matter where you are there's a "Genetron" wholesaler as near as your telephone. Make *your* next order—*"Genetron."*

QUICK FACTS on GENETRON Super-Dry Refrigerants

- Guaranteed exceptionally low moisture content.
- Noncorrosive to standard equipment materials, nontoxic, nonflammable, stable, safe.
- Critical and freezing points well outside range of operating uses.
- Solvent action on oil helps prevent solidification or congealing of lubricant; aids in lubrication of equipment; generally miscible with oil.
- Freely interchangeable and may be mixed in any proportions with comparable fluorinated hydrocarbons meeting the same strict refrigerant specifications.
- Available everywhere, from refrigeration wholesalers throughout the country.

GENETRON 11 ORANGE LABEL CCl_3F
Trichloromonofluoromethane

GENETRON 12 WHITE LABEL CCl_2F_2
Dichlorodifluoromethane

GENETRON 22 GREEN LABEL $CHClF_2$
Monochlorodifluoromethane

GENETRON 113 PURPLE LABEL $C_2Cl_3F_3$
Trichlorotrifluoroethane

GENETRON 114a BLUE LABEL $C_2Cl_2F_4$
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... and that's what they get when you select Westinghouse Life-Line "A" motors for your air conditioning systems

Everybody appreciates a quiet-running air conditioning system . . . many people, by the very nature of their work, not only desire it, they demand it. And, one of the surest ways you can give your customers the quietness they require is by selecting Westinghouse Life-Line® "A" motors for your industrial and commercial air conditioning systems.

Completely sound-engineered, each Westinghouse Life-Line "A" receives a total of 34 separate checks and tests to make sure that you get the quietest motor available today . . . a motor which will contribute substantially to the satisfaction your customers receive from your air conditioning systems.

In addition, your customers will benefit from greatly simplified motor maintenance. Pre-lubrication coupled with fortified insulation and close-tolerance machining makes the Life-Line "A" the nearest thing to a maintenance-free motor available.

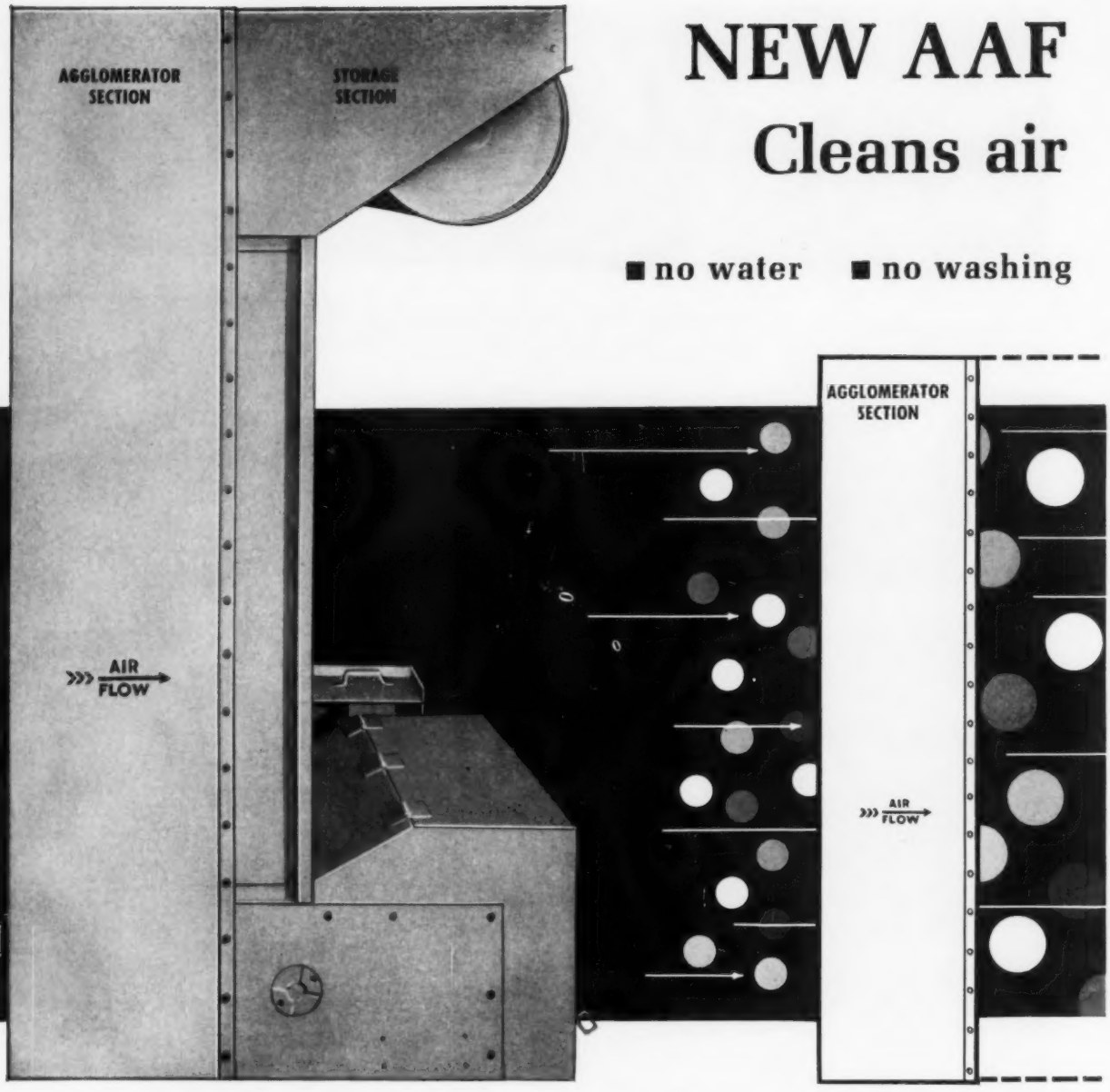
For more information on the Life-Line "A" for air conditioning drives, contact your Westinghouse representative. Or, write Westinghouse Electric Corporation, P.O. Box 868, 3 Gateway Center, Pittsburgh 30, Pa. J-22127

YOU CAN BE SURE...IF IT'S Westinghouse

"K" LINE
MOTORPUMP
Ingersoll-Rand Company is now offering for air conditioning service, its new line of "packaged" Motorpumps known as the "K" Line. From the extensive and complete Motorpump line these 20 units are available at really competitive prices to suit any condition for deliveries to 775 gallons per minute with heads ranging to 190 feet.
Backed by the recognized leader in centrifugal pumps, "K" Line Motorpumps are designed and built for rugged, dependable service—*complete* customer satisfaction . . . Prove to yourself that the "K" Line can be your "profit" line—write today for complete information to:
Sales Manager, Merchandising Division
Ingersoll-Rand Co.
11 Broadway, New York 4, N. Y.
Ingersoll-Rand
Merchandising Division
11 Broadway, New York 4, N.Y.
9-872A

NEW AAF Cleans air

■ no water ■ no washing



Here is the only air filtration unit in the world that offers

- **the efficiency of an electrostatic precipitator, and**
- **the minimum maintenance of an automatic-renewing, disposable media air filter,**

both in one space-saving unit!

This revolutionary new air cleaner is the Rollotron. Its unique operating principle is shown in the exploded "flow diagram" illustration.

In overall size, the Rollotron requires no more space than any other electrostatic precipitator. Regardless of unit height or width, depth is only 39"!

1 TRAP THE DUST ELECTRONICALLY!

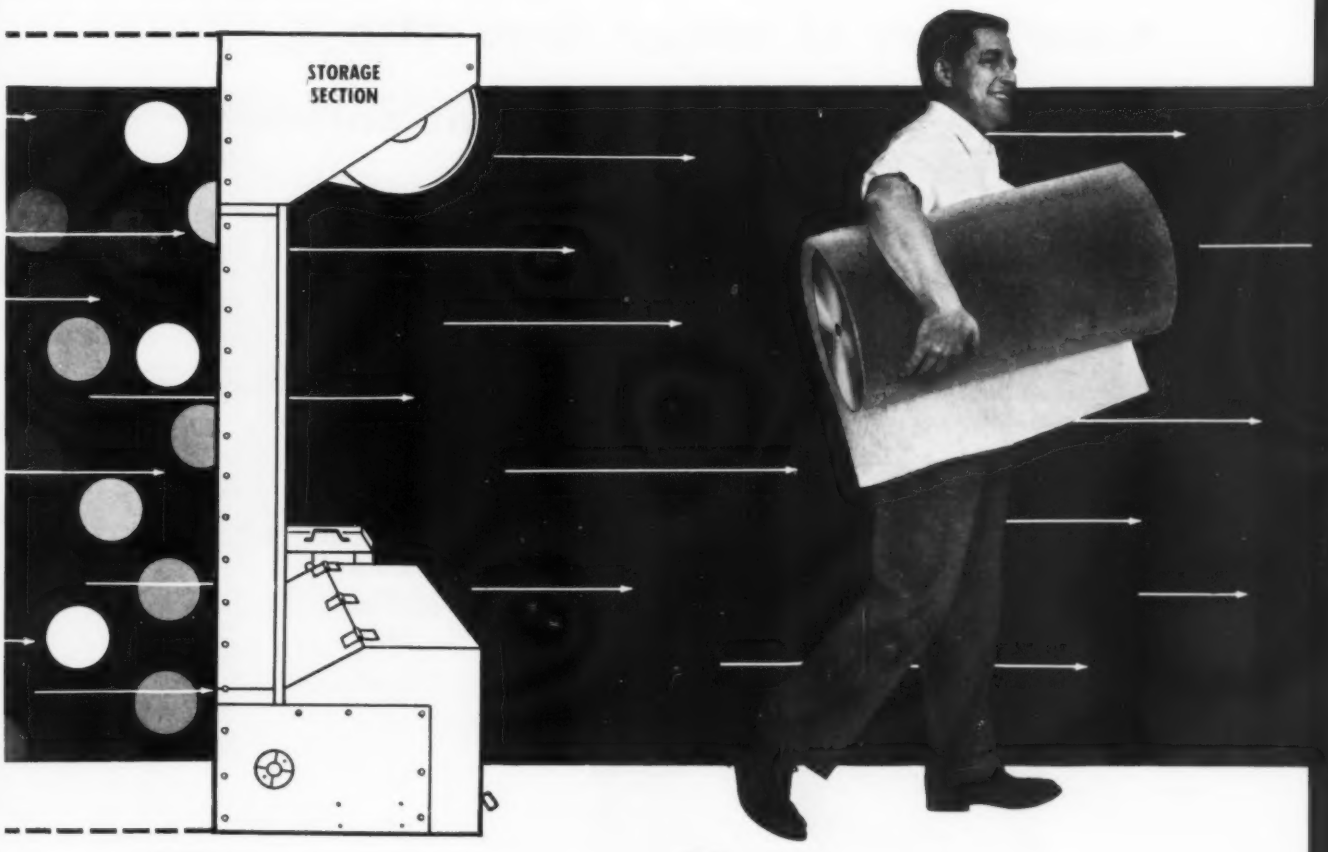
Minute dust particles are electrostatically attracted and adhere to each other on the *dry* plates of the agglomerator section. As the trapped dust particles build up (agglomerate) on the collector plates, the "mass" increases until the accumulation is swept off the plates by the air stream. Dirt is then carried onto the bonded glass fiber media of the storage section.

Maintenance on precipitator section? Virtually none. No oiling, no washing, no water, no freezing, no drains.

ROLLOTRON

electronically, rolls away the dirt!

■ no freezing problems ■ no drains ■ no oiling of plates



2 ROLL IT UP AUTOMATICALLY!

A bonded glass fiber "blanket" is fed automatically down the face of the storage section from a roll at the top. The used media—and accumulated dirt—are wound tightly into a compact roll at the bottom.

Maintenance? Simply replace the soiled roll with a clean one—an operation as simple as changing the film in your camera! In normal service, this is required only about once a year! The Rollotron makes scheduled maintenance a thing of the past!

3 TAKE IT AWAY PERIODICALLY!

With quick, easy media replacement, the Rollotron is again ready to give maximum air cleaning—*electrostatic* air cleaning—for months to come!

For complete information on "electronically clean air by the roll" see your local AAF representative or write for Rollotron Bulletin 249. Address: Mr. Robert Moore, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Kentucky.

AAF American Air Filter

BETTER AIR IS OUR BUSINESS

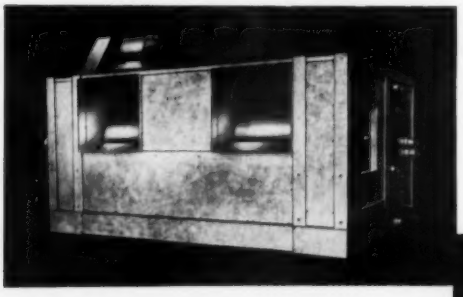
BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

Carrier

Save hours of design time with this one Weathermaker that solves scores of air conditioning problems!

Just study the opposite page for a moment. See how easy it is to tailor the new Carrier 39AC Single-Zone Weathermaker* to your central station air conditioning jobs. "Building-block" flexibility simplifies unit selection and location; enables you to satisfy all system requirements quickly and precisely. Another big timesaver is the new 72-page Carrier Catalog 39ACW-55—so complete it is the only reference you need to use. Chilled water or direct expansion coils may be selected either from entering and leaving conditions or by using apparatus dewpoint. No basic data calculations required. For your copy of the catalog, phone the Carrier office nearest you. Or write Carrier Corporation, Syracuse 1, New York.

* Reg. U.S. Pat. Off.



← Typical horizontal arrangement

Typical vertical arrangement ↓

39AC Single-Zone Weathermakers. For conventional systems. Choice of direct expansion or chilled water cooling coils; steam or hot water heating coils. Eight sizes, from 2400 to 40,750 cfm; coil face velocities from 300 to 700 fpm; static pressures up to 4 inches. Carrier also offers 39W Multi-Zone Weathermakers for simultaneous independent cooling or heating in up to 14 different zones. 8 sizes; same cfm range, coil face velocities and static pressures as 39AC.

THESE BUILDING-BLOCK COMPONENTS FIT TOGETHER IN SCORES OF DIFFERENT WAYS

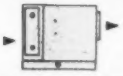
FAN SECTION. This component is the cornerstone of all 39AC arrangements. It provides a choice of discharge directions as well as fan motor locations.

COOLING COIL SECTIONS. Short type assures extreme compactness; standard cooling coil section permits cooling with reheat. Or you may use both coils.

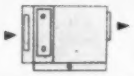
DRIP PANS. Two are available—one long, one short. Note in typical examples below how this choice of pan sizes increases freedom of arrangement.

ACCESSORIES. Over a dozen matching accessories make available every function of year-round air conditioning in one compact central station unit.

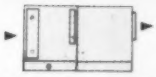
TYPICAL HORIZONTAL ARRANGEMENTS



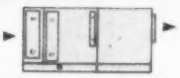
1. Short cooling coil section, fan section and long drip pan. For summer cooling only (DX); or summer cooling and winter heating with water.



2. Auxiliary heating coil section, short cooling coil section, fan section, long drip pan. For summer cooling, winter heating, each with its own coil.

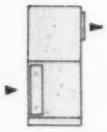


3. Standard cooling coil section fitted with cooling and heating coils, fan section, short drip pan. For summer cooling with reheat, winter heating.

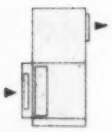


4. Short and standard cooling coil sections, fan section, long drip pan. Extra cooling surface for summer cooling with reheat, winter heating.

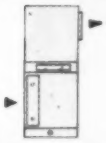
TYPICAL VERTICAL ARRANGEMENTS



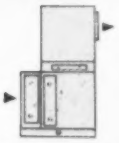
5. Standard cooling coil section, fan section, short drip pan. For summer cooling only (DX); or summer cooling and winter heating with water.



6. Auxiliary heating coil section, standard cooling coil section, fan section, short drip pan. Summer cooling, winter heating, each with its own coil.

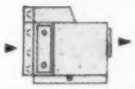


7. Standard cooling coil section, auxiliary heating coil section, fan section, short drip pan. For summer cooling with reheat, winter heating.

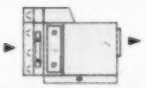


8. Short and standard cooling coil sections, auxiliary heating coil section, long drip pan. Extra cooling surface for same service as Number 7.

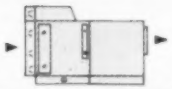
HORIZONTAL (WITH BYPASS)



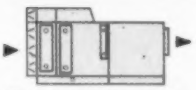
9. Same arrangement and functions as Number 1, but with face and bypass dampers and external duct added to provide this control.



10. Same arrangement and functions as Number 2, but with face and bypass dampers. Note duct permits bypass of both heating, cooling coils.

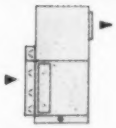


11. Same arrangement and functions as Number 3, but with face and bypass dampers. Duct permits bypass of cooling coil but not heating coil.

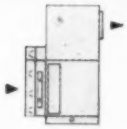


12. Short and standard cooling coil sections, heating coil, long drip pan. Duct permits bypass of cooling coils but not heating coil.

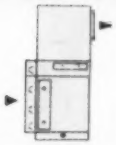
VERTICAL (WITH BYPASS)



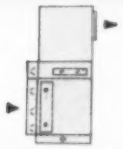
13. Same arrangement and functions as Number 5, but with face and bypass dampers. Note in this setup no external bypass duct is needed.



14. Same arrangement and functions as Number 6. Here a small sheet metal adapter is required to complete the installation of the bypass.

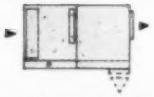


15. Same arrangement and functions as Number 7. Here a special "bypass heating coil section" is required to provide inlet for the bypass air.

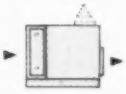


16. Same arrangement and functions as Number 15, except heating and coil position is changed so air will bypass both heating and cooling coils.

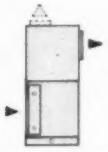
FAN DISCHARGES



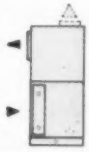
17. Fan section may be rotated about the shaft, or end for end. Drawing here shows top horizontal discharge or alternate downblast.



18. Another variation with short coil section permits either horizontal discharge from bottom of fan section, or alternate true upblast.

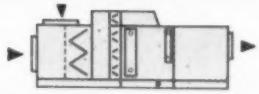


19. Either truly horizontal or truly upward discharges may also be attained with the vertical arrangement of 39AC components, as illustrated.

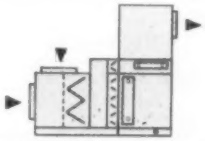


20. In this arrangement of the fan section, the vertical unit provides horizontal discharge and at the same time reverses direction of the air.

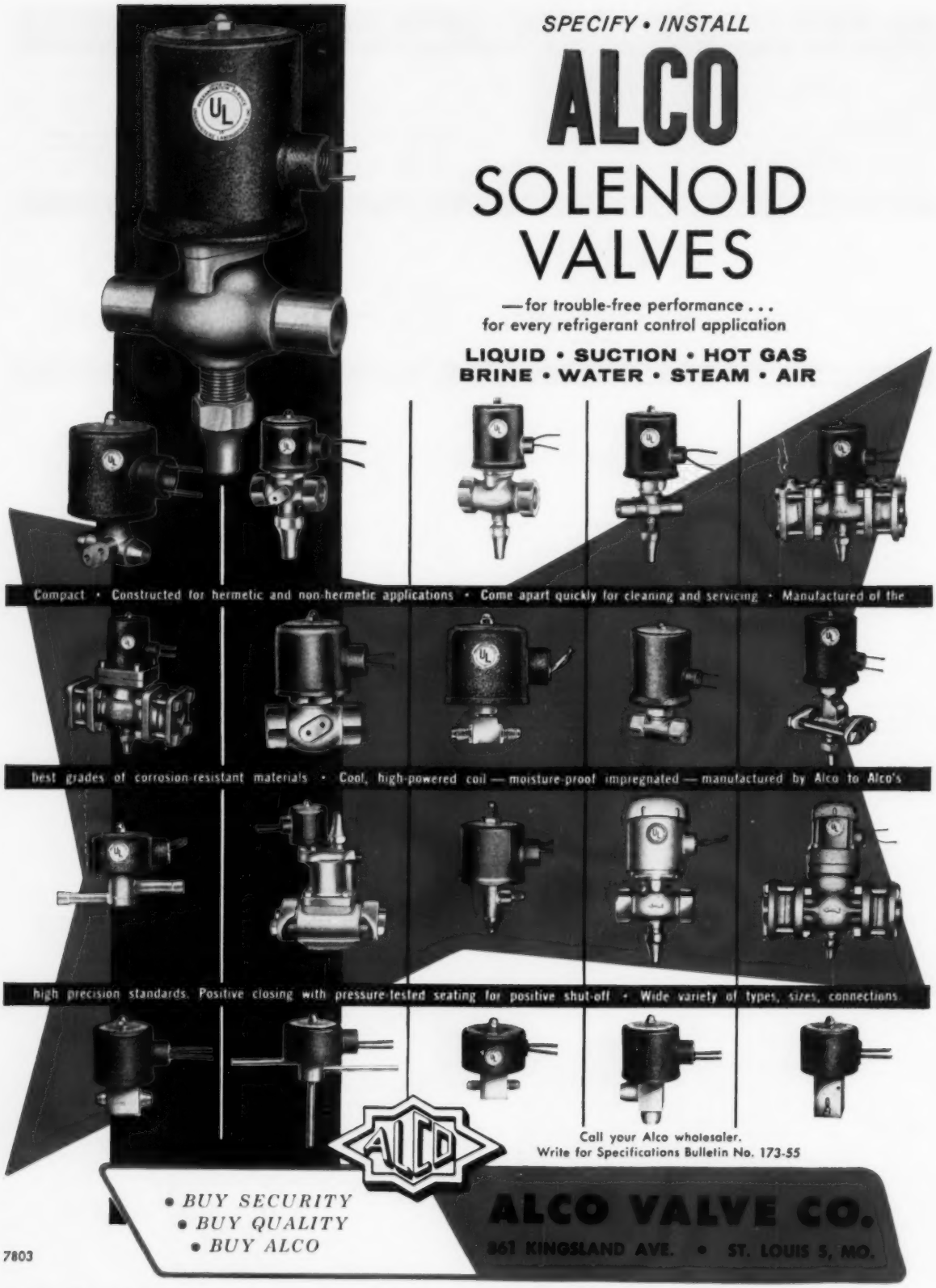
ACCESSORIES



21. Typical horizontal arrangement featuring these standard accessories: mixing box assembly with interconnected double acting damper blades and low velocity filters; plenum section; face and bypass damper section and bypass duct assembly. As in all arrangements, spray humidifier section can be inserted ahead of cooling coil.



22. This vertical arrangement features these accessories: mixing box assembly with damper blades and filters; plenum section; face and bypass damper section; auxiliary heating coil section. Note this setup provides full year-round service with excellent control in a package that makes economical use of valuable floor space.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Today Anemostat offers an impressive variety of air diffusion equipment to meet every architectural and engineering requirement. ANEMOSTAT® is a registered trademark. It is your guarantee that every unit bearing this name is of highest quality . . . backed by the most experienced engineering, research and testing laboratories in the industry.

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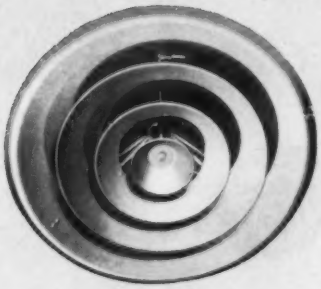
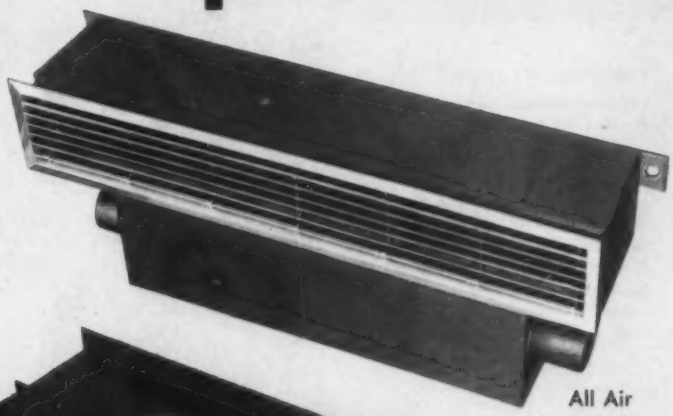
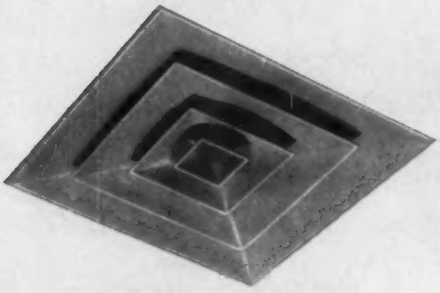


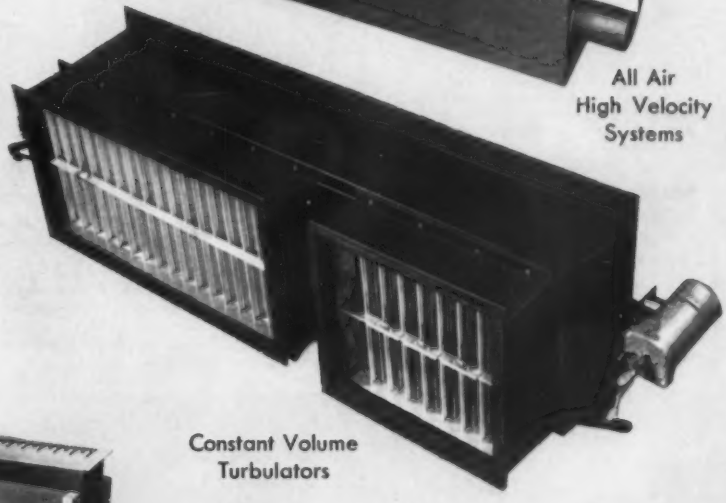
Conventional Air Diffusers



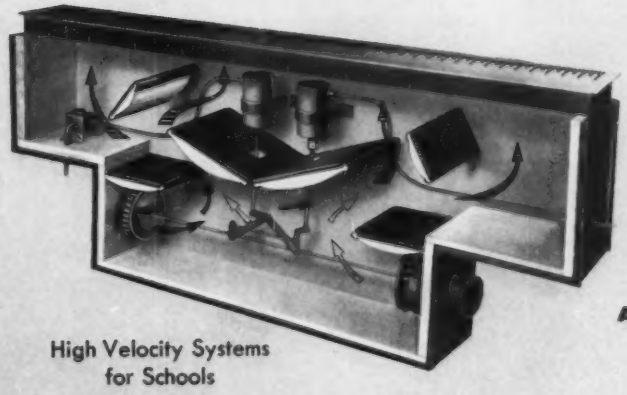
All Air High Velocity Systems



100% Induction Air Diffusers



Constant Volume Turbulators



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AC1370

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The first all privately-financed nuclear power plant.

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Pacific Gas & Electric Co.
and
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Architects and Engineers:
Bechtel Corp.
all of San Francisco

Mech. Contractor:
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POWERS CONTROL

here is used in the power plant. It meets the rigid standards required in regulating ventilation supplying personnel with safe, comfortable, uncontaminated air.

Industrial Reactor Laboratories, Inc.

Plainsboro, N. J.

Architects:
Skidmore, Owings & Merrill

Mech. Engineer:
Guy B. Panero

Mech. Contractor:
August Arace, Inc.

General Contractor:
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Prime Contractor **AMF ATOMICS**

POWERS CONTROL

here regulates the heating, ventilating and air conditioning in the reactor and laboratory buildings.

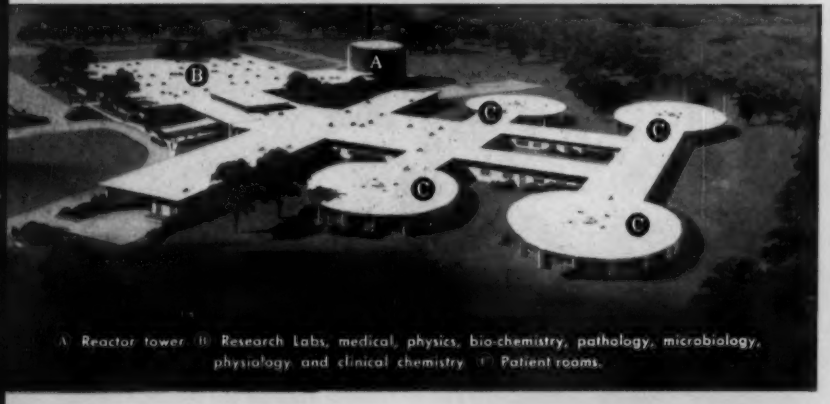
Owner-members of Industrial Reactor Laboratories: American Machine & Fdry Co., American Tobacco Co., Atlas Powder Co., Continental Can Co., Corning Glass Works, National Distillers & Chem. Corp., National Lead Co., Radio Corp. of America, Socony Mobil Oil Co., U. S. Rubber Co.

Medical Research Center, AEC Brookhaven National Laboratory,

Upton, N. Y. — Nuclear research here will benefit all mankind. The first nuclear reactor (1000 kw) designed specifically and exclusively for medical research and treatment is located in the reactor tower Ⓐ shown below.

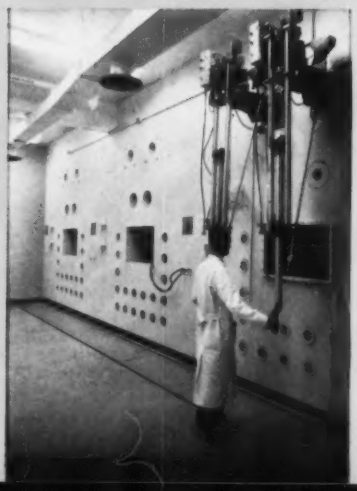
Architects: **Eggers and Higgins** • Mechanical Engineers: **Syska & Hennessy**
Mechanical Contractor: **Malan Construction Corp.** • All in New York City

POWERS CONTROL in these completely air conditioned buildings regulates temperature, humidity and ventilation.



A Reactor tower B Research Labs, medical, physics, bio-chemistry, pathology, microbiology, physiology and clinical chemistry C Patient rooms.

Below: Operators at Industrial Reactor Laboratories, protected by 3 ft. thick viewing windows, conduct experiments with master-slave manipulators shown below.



POWERS CONTROL

...keeps pace with the demands of modern science and industry

At the Birth of the Atomic Age in 1942 at the University of Chicago, temperature of the space occupied by "the first nuclear reactor" was controlled by Powers Type K Thermostats installed under the West Stands of Stagg Field.

In 1944 at Hanford, Wash., Powers Transmitter Controls regulated temperature of the huge volume of water required for cooling the nuclear reactors. The capacities of ten 2500 ton YORK refrigeration compressors, made especially for this important project, were regulated by Powers Series 100 Transmitters and Receiver Controllers. They also controlled 24" butterfly valves used to regulate the distribution of refrigerated air.

Inside the dome at IRL a crane services reactor pool. Powers control here, regulates the ventilation and air conditioning. Note ducts on circular wall.

Accurate Control of Air Conditioning is Vital in modern nuclear reactor plants. Safety and comfort of employees and reliability of ventilation controls are specially important in radioactive "hot" areas. In the three prominent installations on the opposite page, Powers control is required to meet rigid standards of performance.

Other Users of Powers Controls: Some AEC buildings in Oak Ridge, Tenn.; at Argonne National Laboratory, air conditioning and cooling water for a Cyclotron is regulated by Powers; in AEC plants at Portsmouth and Fernald, Ohio and Weldon Spring, Mo.; in Atomic Energy of Canada Ltd., buildings 145 and 465 at Chalk River, Ont., Powers controls heating and air conditioning.

Nuclear Reactor Research Facility of the U. S. Naval Research Laboratory, Wash., D.C. is air conditioned and Powers controlled.

At Illinois Institute of Technology, Chicago, the first nuclear reactor for private industrial research was installed by the Armour Research Foundation. Powers air conditioning control is installed here in the Physics and Electrical Engineering Research building in which the reactor is located.

For Your New Building — Whether its a school, hospital, commercial or industrial building, ask your architect or consulting engineer to include a Powers Quality System of Temperature Control. You will benefit from — **Powers complete responsibility** for a correctly engineered control system, proper installation, continuous successful operation and *SERVICE* when required from offices in 85 cities.

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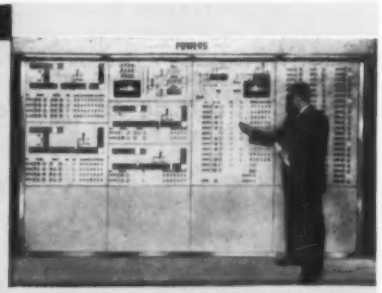
SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A. and Canada*

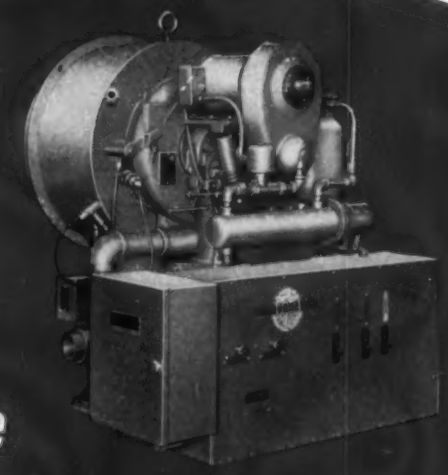
65 Years of Automatic Temperature, Humidity Control

A few Powers Temperature..Humidity..and Pressure Controls



Powers Graph-O-Matic Control Centers are also available in Console models. All types are custom built to meet the requirements of any comfort or process control system.

NEW LOW COST PACKAGED FORCED DRAFT BURNERS



40 to 90 Horsepower units added to RAY Line

COMPACTLY CONSTRUCTED

FULLY AUTOMATIC

INSTANT FUEL CHANGEOVER

LIGHT OR HEAVY OIL OPERATION

ELECTRONIC CONTROLS

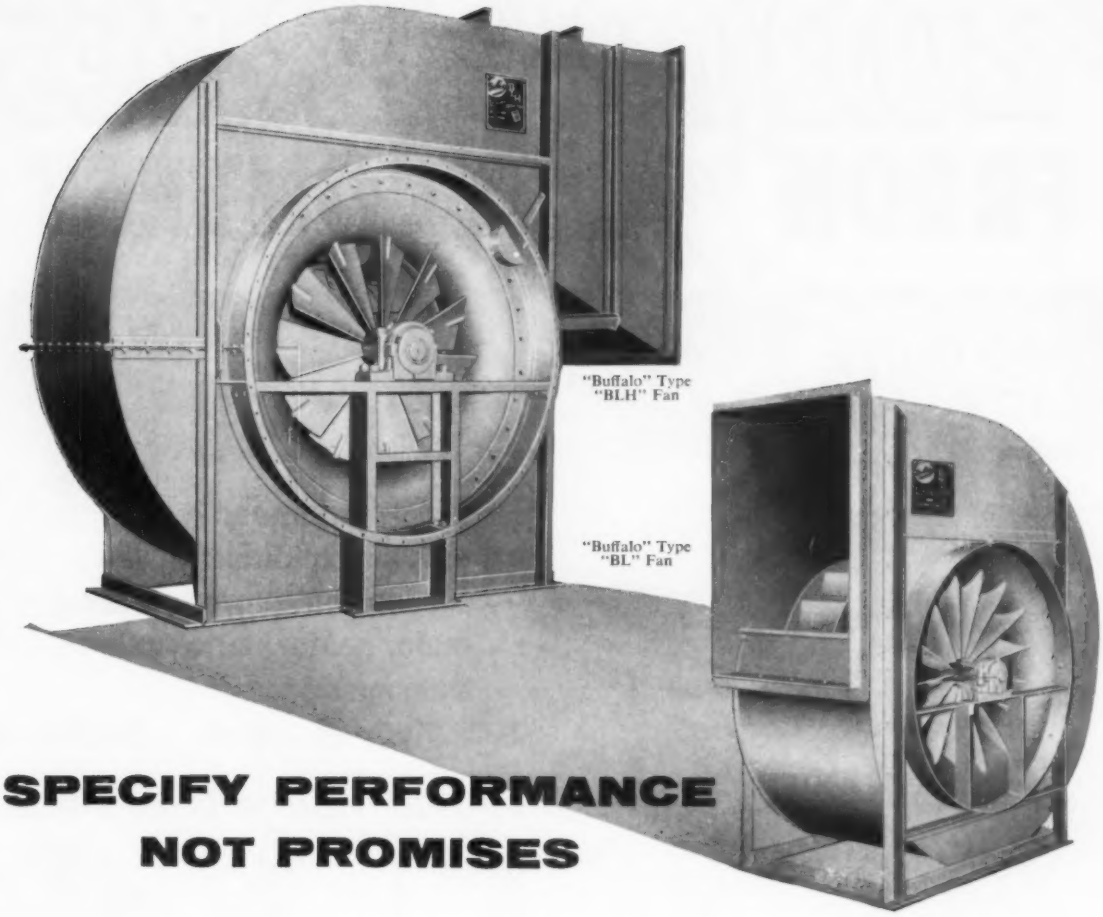
These factory assembled units are ready for application as complete combustion systems to multiple pass Scotch Marine, Water Tube and Firebox boilers and to other types of heat receivers designed for pressurized operation.

Send for complete technical data bulletin Y-1

RAY BURNER COMPANY

1301 San Jose Avenue, San Francisco, California

629 Grove Street, Jersey City, New Jersey



SPECIFY PERFORMANCE NOT PROMISES

Promised catalog ratings and actual on the job ratings are not always the same. When you specify "Buffalo" Fans you can always be sure that fan *performance* will confirm your good judgment. Buffalo Forge Company's 81 year reputation for highest engineering and manufacturing standards is assurance that you will obtain fan performance to meet the *exact* requirements of each job.

FOR HIGH PRESSURE REQUIREMENTS:

Designed especially for Class III and IV construction, the "Buffalo" Type "BLH" fan will provide peak performance for your high pressure systems. It affords a mechanical efficiency of 86% over a wide range, while maintaining stability of performance from free delivery to shutoff. The "BLH" features a smooth inlet bell, directional inlet vanes, backward-curved blades and divergent outlet. These factors reduce turbulence to a minimum, and give very quiet operation. An added feature is the non-overloading characteristic. Bulletin F-201 gives complete details.

FOR MODERATE PRESSURE REQUIREMENTS:

The "Buffalo" Type "BL" Fan is an ideal choice for your Class I and II ventilating and air conditioning installations. Its high static efficiency over a broad range has been proved in hundreds of applications. The "BL" has many of the unique "Buffalo" features of the "BLH": it is non-overloading, and is designed for minimum turbulence and ultra-quiet operation. Other features are the factory-balanced wheel to minimize vibration and the wheel-contoured housing with large, correctly-shaped scroll. Write for Bulletin F-104.

Only "Buffalo" offers you the "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

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BUFFALO FORGE COMPANY

Buffalo, N. Y.

Buffalo Pumps Division • Buffalo, N. Y.
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FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

$20,000.00 IN PRIZES

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1959 Kingswood with air conditioning, air suspension, power steering, radio, heater, automatic transmission . . . fully equipped . . . $4,000

3-2ND PRIZES

$1,000 UNITED STATES SAVINGS BONDS

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POLAROID "HIGHLANDER" CAMERAS worth $72.75 each

250-5TH PRIZES

WESTINGHOUSE TRANSISTOR PORTABLE RADIOS worth $39.95 each

-284 CHANCES TO WIN!

Hints to help you win

Your complete air conditioning and refrigeration wholesaler *is your partner in profit.* It will pay you to know and use his services, cultivate his friendship. Here are some of the benefits you get by dealing through your wholesaler.

- **Convenience of buying** at a one-stop supply source. Your wholesaler keeps ample, diversified stocks of high-quality air conditioning and refrigeration parts, equipment and supplies.
- **Immediate delivery** by your wholesaler permits you to give prompt, dependable service—imperative in emergencies.
- **Cost savings** because your wholesaler assumes expenses of inventory, warehousing, shipping, accounting and insurance.
- **Expert technical and engineering help** when you want it. Your wholesaler assists with design problems, figuring material costs; gives catalog service, prices and up-to-date information on new products.

"Freon" Check List

Look for this list of premium qualities of "Freon" refrigerants on your official entry blank. Check the one you consider most important.

- ☐ Time-tested—over 27 years in use—you can't go wrong with "Freon."
- ☐ Stable, pure and dry.
- ☐ Factory-sealed for purity.
- ☐ Nontoxic, nonflammable.
- ☐ Always available—anywhere in the world.
- ☐ Made by Du Pont—backed by years of technical and manufacturing leadership.

Insist on genuine "FREON"—Premium Quality Refrigerants . . . in the cylinders with the gold-head caps.

DU PONT — Better Things for Better Living . . . through Chemistry

"FREON" PRODUCTS DIVISION
E. I. DU PONT DE NEMOURS & CO. (INC.)
WILMINGTON 98, DELAWARE

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CONTRACTORS, SERVICE MEN . . . You are eligible to win an air-conditioned 1959 Chevrolet station wagon if your company has bought Freon® refrigerants from a complete air conditioning and refrigeration wholesaler within the contest period (January 26, 1959—May 15, 1959). Read over the simple rules and hints to help you win. Then just tell us why *you* think it's good business to deal with a *complete air conditioning and refrigeration wholesaler.* It's easy! Enter often! You can get official entry blanks through your wholesaler. Ask him about the Freon® "Partners in Profit" Contest *today.*

SIMPLE CONTEST RULES:

1. Contest is open to all firms and their employees who are customers of complete air conditioning and refrigeration wholesalers providing that the customer firm purchases "Freon" refrigerants from a complete air conditioning and refrigeration wholesaler during the contest period (January 26, 1959 to May 15, 1959). Employees of E. I. du Pont de Nemours & Co., its subsidiaries, its agencies or its wholesale distributors of "Freon" refrigerants are not eligible to enter the contest.

2. Check the quality of "Freon" most important to you.

3. Complete this statement in 35 *additional* words or less: "I believe it is good business to deal through a complete air conditioning and refrigeration wholesaler because . . ."

Mail your entry to: **FREON® CONTEST, Box 22F, Mount Vernon 10, New York**

Entries must be postmarked by May 15, 1959, and received by us at least within eight days of this date.

4. You may enter as often as you like. Your entry must be your own original work and must be submitted in your own name, on an official entry blank, obtainable through your complete air conditioning and refrigeration wholesaler.

5. Prizes awarded by Reuben H. Donnelley Corp., on the basis of their judgment regarding originality, sincerity and aptness of thought. Duplicate prizes awarded in case of tie.

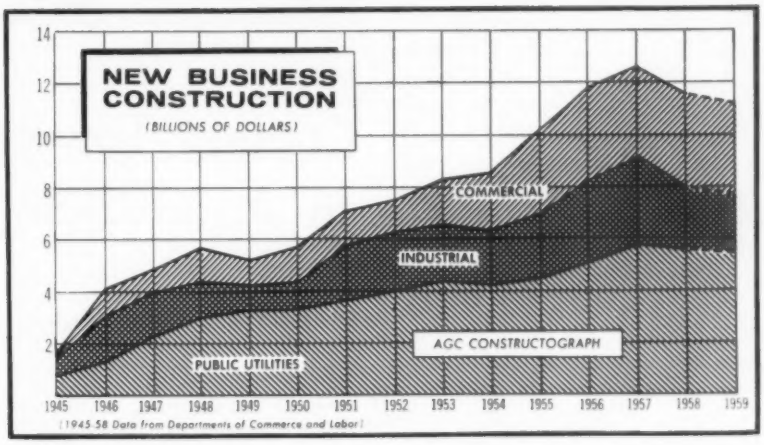
6. Judges' decisions are final. All entries and ideas become the property of E. I. du Pont de Nemours & Co. (Inc.). None will be returned. Contest is subject to federal, state, and local regulations.

7. Winners will be notified about six weeks after close of contest.

Heating Piping & Air Conditioning

February 1959

You'll Want To Know...



For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

Record Breaking Construction Volume Seen for '59

TOTAL CONSTRUCTION performed in the U. S., after breaking dollar volume records in the face of the general business decline of 1958, stands a good chance of reaching the $72 billion mark in 1959 with a 6 percent advance, the Associated General Contractors of America reports.

The forecast for 1959 is divided into $52.2 billion in new construction and nearly $20 billion in maintenance and repair, while work put in place in 1958 is estimated at nearly $49 billion in new construction and $18.6 billion in maintenance and repair, for a total in excess of $67.5 billion.

A 16 percent rise in public construction, featuring increases in every category of state and local public works will dominate the 1959 construction scene. In the private sector, a moderate advance in residential activity and continued high levels of commercial and public utility construction should more than offset a further slide in industrial building and a slight drop in farm construction.

The AGC's annual review and outlook statement estimated that construction of all types in 1958 increased 3 percent over 1957, and saw increasing contract awards and improving economic conditions as heralding the beginning of a new era of construction growth in 1959.

Commercial construction should

continue at the peak level of $3.6 billion with brisk activity in chain stores and shopping centers.

Religious construction may hit the $1 billion mark for the first time in a 15 percent advance.

Industrial building should decline at a reduced rate, about 10 percent, to $2.2 billion, due to fewer projects planned. A pickup in capital expenditures throughout 1959 will lay the foundation for a rising volume of business construction in 1960.

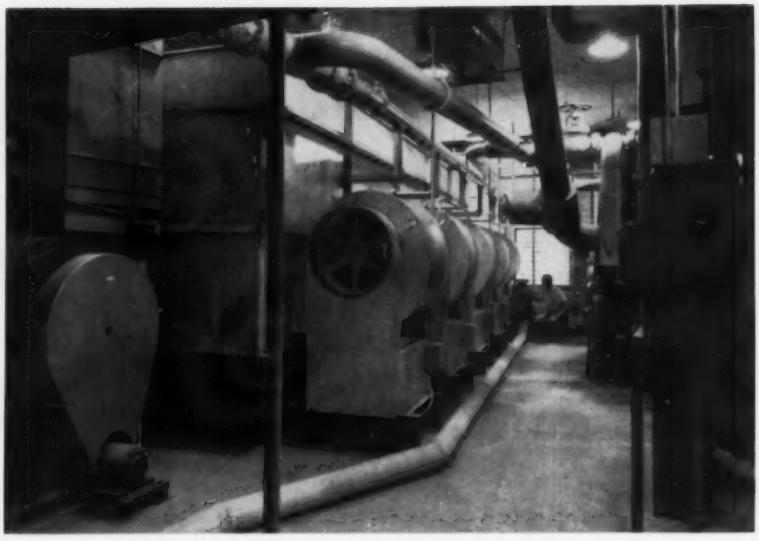
Gas Utility Growth Seen For '59

WITH A record-breaking 32 million customers and current annual sales of more than $4.5 billion, the gas utility and pipeline industry looks forward to 1959 as another year of growth and service, according to J. Theodore Wolfe, American Gas Association president.

As evidence of this confidence, the industry will spend between $1.7 and $1.8 billion in 1959 for the construction and development of gas transmission, distribution and storage, with about 97 percent of these funds earmarked for natural gas facilities. Construction outlays will total $8.1 billion for the four year period from 1958 to 1961, compared with $5.7 billion spent in 1954-57 and $5.1 billion in 1950-53.

Throughout the United States today the industry is providing service for 32.1 million utility customers. They receive gas from approximately 1300 distribution companies supplied by about 100 transmission companies.

You'll Want To Know



Cooling Towers Save Money In Auditorium Installation

FOR EVERY 24 hr period the air conditioning system in the new 6500 seat Civic Auditorium in Albuquerque, N. M., is in operation, management saves an estimated $2000 through the use of cooling towers, according to Binks Mfg. Co.

Without the cooling towers, the 270 ton air conditioning system would use 2.4 gpm of water per ton, or 936,000 gal of water per day. At Albuquerque water prices of $17.55 per 10,000 gal, it may be seen that air conditioning the new auditorium would have been out of the question without some water conservation method.

Because of the unusual lines of the $1½ million Albuquerque auditorium — a 62,000 sq ft, one-story structure with convex domed roof — it was particularly important that all of the air conditioning equipment including the cooling towers be concealed. The two cooling towers, with 10 sections or blowers in all, are housed in a penthouse atop the lobby of the structure.

The rest of the air conditioning equipment in the equipment room includes a 270 ton steam absorption refrigeration unit, together with a 100 hp steam boiler. Approximately 90,000 cfm of air is supplied from the equipment room against a static pressure of 2½ in. water gage to 24 circular air diffusers mounted on a circular acoustical baffle, suspended from the roof-dome.

ARI Directory of Unit Conditioners Now Available

THE FIRST EDITION of a "Directory of Certified Unitary Air-Conditioners," a keystone of the air conditioning seal of certification program, is now available from the Air-Conditioning and Refrigeration Institute.

The new directory, containing the certified ratings of the unitary air-conditioning equipment produced by 30 manufacturers will be widely distributed to contractors, builders, government purchasers at all levels, and to distributors and dealers within the industry. The directory lists the cool-

ing capacities and other characteristics of these units.

Unitary equipment includes all central residential air-conditioners and many unitary installations such as those used in small commercial establishments, but does not include room air conditioners, heat pumps, or large field assembled "systems," such as those used in large buildings, theatres, etc.

The program for rating, testing, and certifying unitary equipment was developed by the unitary air conditioner section of ARI, with the cooperation of the National Warm Air Heating and Air Conditioning Association, and is based on two ARI Standards — ARI Standard 210-58, unitary air conditioning equipment, and ARI Standard 250 58, heat operated unitary air conditioning equipment.

The 30 participants in the unitary certification program have signed firm contracts with ARI, agreeing to produce, test, and rate their units in accordance with the applicable ARI Standard, and to supply test data to the Institute. If the unit is accepted, this data is published in the directory, and the manufacturer is given the right to use the certificate and seal on his equipment, in advertising, and in promotional literature.

UA Pipe Fitter Apprentice Contest To Be August 9-14

THE SIXTH annual international contest for pipe fitter apprentices will be held at Purdue University, Lafayette, Ind., August 9 to 14, according to Joseph P. Corcoran, director of the training department of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U.S. and Canada.

Participants will be fifth year apprentices who are members of a local union of the UA and winners of state or provincial fifth year apprentice contests. Only one from any state or province may enter.

Heating Plant on Roof Saves Store Floor Space

A HEATING PLANT on the roof is one of the design features of the new Wolf & Dessauer department store in Fort Wayne, Ind.

The boiler room is encased in a penthouse on the roof of the building. The arrangement was made to save valuable merchandising room on other floors and to cut installation costs. In this application, the smokestack is completely contained on the roof instead of cutting through the entire four stories of the department store.

Two tanks, submerged under the lower level, pump oil to the roof for use in the heating plant. Each tank has a capacity of 20,000 gal.

The store's 700 ton air conditioning plant is also in the utility penthouse on the roof.

The systems were designed by A. Epstein & Sons, architects and engineers.

Predict Heavier Industrial Instrumentation Activity in '59

INCREASED ACTIVITY in industrial instrumentation is forecast for 1959 by Henry F. Dever, vice president, Minneapolis-Honeywell Regulator Co., after what he calls a year of widely divergent trends in the application of automatic controls.

An improved economy, heavy emphasis on research, probable increases in defense spending, and an upward swing in capital outlays by industry were cited as forces stimulating wider interest in the "tools of automation."

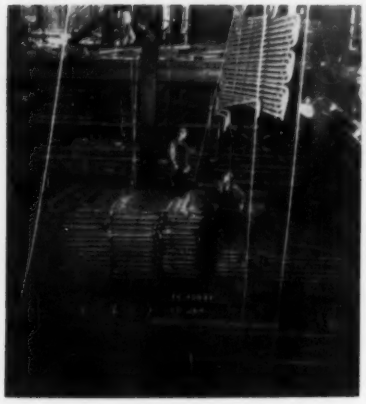
"Capital spending during a period of recession and immediately thereafter is pointed more toward modernization than to new capacity," Mr. Dever said. "The pressure behind this is the compelling need to reduce costs and increase productivity so as to minimize the inroads of competition and to grow at a profit. It is a pressure that acts as a tailwind."

He cited a recent survey reporting that $70 billion would be needed to replace obsolescent equipment in the manufacturing, mining, petroleum, electric and gas, and transportation and communications industries.

There are "no straws in the wind" to indicate that the instrument industry's sales would match the peak levels of 1956-57, he stated.

You'll Want To Know

Boilers Used As RR Trestles In Power Station Job



DURING CONSTRUCTION of the Thos. H. Allen electric generating station in Memphis, Tenn., each of the three mammoth steam generators acted as its own railroad station. Towering 20 stories above the basement, each steam generator occupies an area of over 1300 sq ft.

Burns and Roe, Inc., New York engineers who designed the plant and supervised its construction, approved the building of a spur from the railroad siding at the plant site onto temporary trestles across the boilers and foundations. Structural steel was brought in, and a major portion of each steam generator was erected with the trestle standing.

After completing the main shell, the area inside each boiler was large enough to accommodate a railroad flatcar. This simplified transportation of many necessary heavy internal components such as superheaters, reheaters, economizers, flues, ducts, etc. The value of this arrangement is emphasized by the quantities of material used: 4000 tons per boiler, including more than 80 miles of steel tubing. Each steam drum alone weighs almost ½ million lb and required the world's biggest flatcar.

Each of the station's steam generators supplies high-pressure steam (2475 psig at 1053 F) to its associated turbogenerator. At optimum operating conditions, each unit will use 2 million lb of steam per hr at a net heat rate of 8860 Btu per kwhr. This compares very favorably with the national average of 11,370 Btu per kwhr.

The design features of the power piping systems for the Thos. H. Allen Electric Generating Station, were discussed in the article "Many Factors Must Be Juggled To Arrive at Most Suitable Power Piping Design" by Frank M. Kamarck, Staff Mechanical Engineer, Burns and Roe, Inc., in the November, 1958, issue of Heating, Piping & Air Conditioning on pages 95-104.

You'll Want To Know

New York Engineers Urge City To Standardize Fees

THE New York Association of Consulting Engineers passed a resolution at its 34th annual meeting recently urging the city of New York to adopt the same fee formula for its construction as prevails in all engineering practice.

This appeal followed the fees committee's report of efforts throughout the year "to improve engineering fees for projects of the city of New York, in particular public schools," and that "progress has been slow and in large part disappointing."

The resolution stated, "An adequate fee for engineering services should be based on an amount equal to two and one-half times the net time card costs of the design staff engaged on the work. This formula is a well established one, and is widely used in our private practice and has found fairly general acceptance all over the country."

Results of the election of officers at the Association's annual meeting found John F. Hennessy, Jr., vice president of Syska & Hennessy, as the Association's new president. Elected vice presidents were Richard T. Baum of Jaros, Baum and Bolles, and Sigmund Roos, head of his own firm. Joseph L. Fraioli of Fraioli-Blum-Yesselman, was elected treasurer and Samuel A. Bogen, head of his own company, was re-elected secretary.

Steel Boiler Sales To Be Up in '59

AFTER A POOR START in 1958, when first quarter shipments averaged 10.9 percent below those for the same quarter in 1957, business activity in the steel firebox segment of the boiler industry has steadily increased, says Steel Boiler Institute president R. A. Locke.

"In October, 1958, the shipments were 10 percent higher than those in October, 1957, and the total for the fourth quarter of 1958 will be considerably ahead of last year. It is estimated that the total shipments in 1958 will be only 2 percent below the 1957 shipments," he said.

"The fourth quarter record and the unusually large volume of inquiries and quotations received by members of the industry," he continues, "indicate a splendid start for 1959."

"And if this pattern is sustained, as we have reason to believe it will be, there should be a 10 percent improvement in 1959 over 1958 totals. Improvements in products, better publicity and better merchandising are all contributing to a more prosperous industry," Mr. Locke concluded.

Standards Set For Yard, Pound, Grain

THE DIRECTORS of the National Bureau of Standards and standards laboratories throughout the British commonwealth have discussed the existing differences between the values assigned to the yard and to the pound in different countries. To secure identical values for each of these units in precise measurements for science and technology, it has been agreed to adopt an international yard and an international pound having the following definitions:

The international yard equals 0.9144 meter;

The international pound equals 0.45359237 kilograms.

It has also been agreed that, unless otherwise required, all nonmetric calibrations carried out by the above laboratories for science and technology on and after July 1, 1959, will be made in terms of the international units as defined above or their multiples or submultiples.

Other definitions of measurements that have been agreed upon are as follows: 1 yard = 0.91440183 meter; 1 inch = 25.4000508 millimeters; 1 international grain = 0.06479891 gram; 1 imperial gallon = 1.20094 U. S. gallons.

Job Health Congress Set For July 25-29

THE 13TH International Congress on Occupational Health will be held in New York City at the Waldorf Astoria Hotel, July 25 - 29, 1960.

The Scientific Program Committee invites submission of papers for presentation at the Congress. The Program will be devoted to the discussion of the following aspects of occupational health: 1) environmental hygiene; 2) influence of environmental; factors in health; 3) work physiology and psychology; 4) specific industries; 5) general problems, and other subjects.

The official languages of the Congress will be English, French, German, and Spanish. Papers in other languages may be read by their authors.

Russia Launches Production In Polyvinyl Plastic Pipe

PLASTIC PIPE is now in production in Russia. Several sizes of reinforced polyvinyl pipe up to diameters of approximately 5 in. were displayed recently at an industrial and agricultural exhibition in Moscow. Pipe joints are connected by means of flanges with rubber gaskets fitted to the inner surface of the flange. These flanges are then drawn together with metal bolts. Polyethylene pipe and tubing is not yet in production, but it is expected to be later in 1959

Heat Pump Costs Assessed by Utility In Philadelphia

THE ATTITUDE of electric utility companies toward the heat pump was the subject of a recent forum held by York Div. of Borg-Warner Corp. at York, Pa.

Arnold D. Spillman, manager of the sales application department, Philadelphia Electric Co., was the guest speaker representing the power companies. In his address, Mr. Spillman singled out the two stage heat pump installation at the Ballinger Co. in Philadelphia as economically ideal.

Data gathered on the heat pump installation at the Ballinger Co. over the past two years by Philadelphia Electric Co. has proven that a night setback (from 72 to 65 F) was not financially advantageous.

Using the night setback, the yearly bill for total electrical usage was approximately $1700. During January and February, the demand went to 175 kw in the morning when the equipment was operated at full capacity to overcome the setback. The following year, without setback but with an increased number of degree days resulting from more severe weather, the total bill stayed around $1700, and the demand stayed below 145 kw. In addition, using a two-stage heat pump resulted in a 5 percent savings in fire insurance rates.

Standards Set by ARI For Heat Transfer

NEW STANDARDS for two separate types of heat transfer equipment made available recently by the Air-Conditioning and Refrigeration Institute are: ARI Standard 430-58, for remote type air handling units; and ARI

You'll Want To Know

Standard 440-58, for remote type room fan coil units.

Both were developed by the Engineering Committee of Sub-Section C of the Heat Transfer Section of ARI, under the chairmanship of R. D. Blum, York Div. Borg-Warner Corp., and were published by ARI's Engineering Department.

As defined in Standard 430-58, a remote-type air-handling unit of the forced-circulation type "is a factory-made encased assembly consisting of a fan or blower and other necessary equipment to perform the functions for which it is intended, but which does not include the source of cooling or heating or the ducts which might be used to distribute the conditioned air."

The Standard classifies remote-type air-handling units in four major categories: (a) ventilating units; (b) heating units; (c) cooling units, and (d) cooling-heating units. It provides testing standards for the different types of units, and rating requirements to which they should be subjected.

Copies of the two new standards are available from ARI, 1346 Connecticut Ave., N. W., Washington, D. C., at 60 cents per copy for ARI 430-58, and 40 cents per copy for ARI 440-58.

See Atomic Development Of Antarctic

ATOMIC ENERGY applications of the future may take man into space, make possible industrial developments in the Antarctic, and foster other dramatic changes in our way of life.

This prospect was presented by Dr. Bernard I. Spinrad of the Argonne National Laboratory, Lemont, Ill., in a talk on "The Future of Atomic Energy" at the Nuclear Energy Awards Banquet of the Engineers' Society of Milwaukee recently.

Dr. Spinrad, director of the Reactor Engineering Division of Argonne, pointed out that the portability of compact and long-lived nuclear fuels conceivably could convert the Antarctic into a valuable resource for the world.

Among other future needs which may be met by nuclear energy Dr. Spinrad listed power sources for the creation of high temperatures needed in certain chemical and metallurgical processes; and radiation sources for sterilization, purification, and for agricultural research.

Piping Saves Water For New Printing Plant

WATER is a vital utility in the printing industry. So it is in the new Meredith Publishing Co. plant in Des Moines, Iowa. Consumption of water for the new plant is expected to be as high as 3000 gpm during peak production periods.

Meredith's new water distribution system is designed to conserve water, and is divided into two parts: one for the printing process, and another for domestic use.

The process water is used for cooling purposes and will leave the plant with only the addition of heat absorbed from the presses. Cooling of the presses and the paper and ink is necessary because of the speed which paper is fed through at the rate of 2000 fpm.

This process water temperature increases 20 F in a few seconds. Each of two new double-six color magazine presses to be installed will require 400 gpm of water. This water is collected in a 12 in. process water return pipe and is then returned to the waterworks.

The piping system for the building is designed so that water may later be conserved by using cooling towers and spray ponds if the city water supply should become inadequate.

You'll Want To Know

Portable Skating Rink In Department Store Cooled With Brine

AN 800 SQ FT portable ice skating rink was installed as a special attraction for the holiday season on the fifth floor of Gimbel Bros. department store in Philadelphia.

For the installation, a vapor barrier was laid inside the wood frame containing the piping for the rink. Waterproof canvas was then spread inside the frame to form the tank for the rink.

Over half a mile of 1 in. pipe was installed in the rink area and covered to the top with about 5 tons of sand.

To build up the ice surface the rink was not flooded, but the sand was cooled and water sprayed over the top to freeze. All parts of the installation were hidden by artificial snow to give a natural appearance.

A 10 hp refrigerating unit cooled the brine for the rink according to Frick Co. A brine surge tank was used for mixing the calcium salt.

One of the unusual features of the installation was the specification that all piping, framing, and other equipment be no longer than 8 ft in order to allow handling in the store's elevators.

MARSH PACKLESS RADIATOR VALVES

WHEEL HANDLE

GRADUATED

LOCK AND SHIELD

ANGLE PATTERN

GLOBE PATTERN

CORNER PATTERN (Sectional Below)

MARSH THERMOSTATIC RADIATOR TRAPS

ANGLE PATTERN

STRAIGHTWAY PATTERN

VERTICAL PATTERN

LEFT HAND CORNER PATTERN

RIGHT HAND CORNER PATTERN

CUT OPEN VALVE

F&T TRAPS

No. 12, REPRESENTATIVE OF WIDE LINE

VENTS

No. 5 VENT, ONE OF MANY

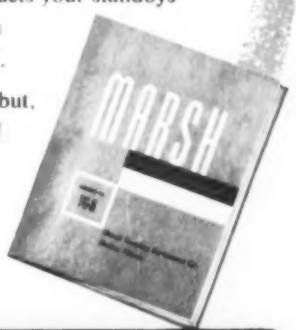
BUCKET TRAPS

No. 500 INVERTED BUCKET TRAP

All the best of their kind!

You probably have made certain Marsh products your standbys without realizing there are a lot more of them just as superlative as the ones you like so well.

Make the acquaintance of some of them here, but, better still—***Ask for this Marsh Catalog!***



MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
DEPT. T, SKOKIE, ILL.
Marsh Instrument & Valve Co. (Canada) Ltd.
8407 103rd St., Edmonton, Alberta

MARSH
Heating Specialties since 1865

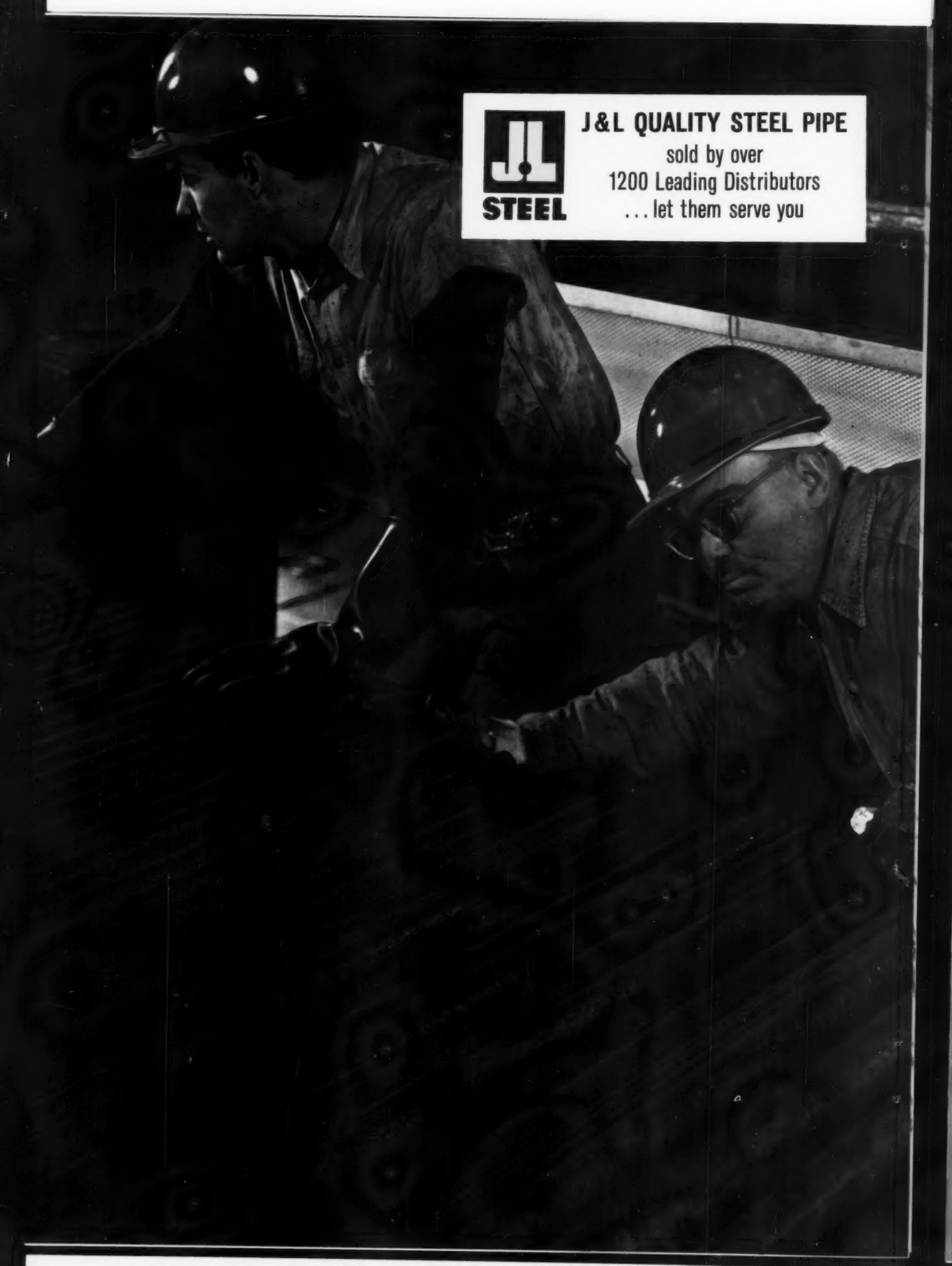
MARSH BOILER GAUGES

THER-ALTI-METER (Square and Round)

INTERNAL SYPHON (Square and Round)

OUNCE-GRADUATED RETARD (Also Compound)

STANDARD (Also Compound)


J&L
STEEL
J&L QUALITY STEEL PIPE
sold by over
1200 Leading Distributors
... let them serve you

"More money in the bank by using J&L pipe"

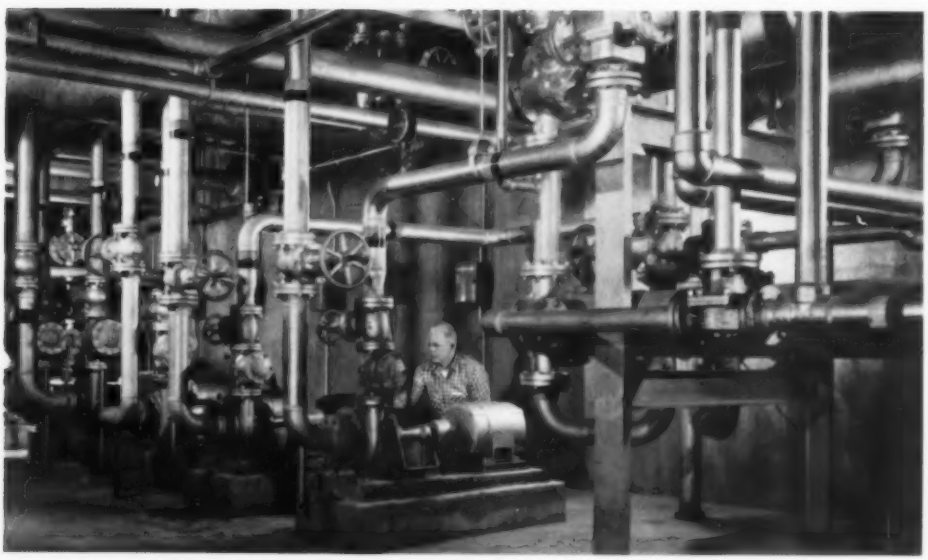
. . . reports Akron contractor

"We use a great deal of J&L standard size pipe because our reputation and our profits depend on our work and the materials we use. J&L pipe gives us sound joints and uniform strength," says Mr. George W. Spohn, of the Spohn Heating and Ventilating Company, Akron, Ohio.

This reputation for dependability of J&L pipe is built on years of outstanding performance. When you specify J&L, you get uniform thickness and size, roundness and straightness, strength and ductility.

J&L pipe is produced by a major integrated steel company on the most modern equipment. Typical of these advanced facilities are two new continuous weld mills for producing Jal-Con-Weld pipe from ½ inch through 4 inches. Jal-Con-Weld pipe is formed by pressure rolls in sizes larger than the finished diameter. Pipe is then reduced in succeeding sets of rolls. This forges the weld and improves metallurgical qualities.

All J&L pipe is manufactured under rigid quality control that assures production of superior products. It will pay you to standardize on dependable J&L pipe. Call your nearest J&L distributor or write Jones & Laughlin Steel Corporation, 3 Gateway Center, Pittsburgh 30, Penna.



Over 300 tons of top quality J&L pipe, ranging in size from 2 inches to 12 inches, were recently installed by the Spohn Heating and Ventilating Company in this modern Akron municipal sewage treatment plant. Dependable service is a must in this operation covering a 700-mile municipal system.

Jones & Laughlin Steel Corporation

PITTSBURGH, PENNSYLVANIA

The closed-cell structure of Armaflex seals out air and moisture, prevents dangerous condensation.

Stop harmful condensation at temperatures down to 0° F. with Armstrong Armaflex

Self-extinguishing Armaflex is completely safe to install before sweat fittings are made. Armaflex is clamped back from fitting, then connection is made.

With the new ¾" thick Armstrong Armaflex Pipe Covering, condensation can be stopped on fluid lines operating as low as 0° F. Armaflex is a highly efficient, flexible insulation with a k-factor of 0.28 at 75° F. mean temperature. Its closed-cell composition needs no separate vapor barrier, effectively seals out air and moisture. At all temperatures from 0° to 200° F., you can specify the economical amount* of Armaflex because it comes in a complete range of nominal wall thicknesses—⅜", ½", and the new ¾".

Faster, more economical jobs result from use of Armaflex. This insulation can cut labor costs by as much as 50%, compared with application costs for conventional, old-fashioned pipe coverings. Armaflex can be slipped over piping before connections are made or slit and snapped on. Joints are sealed with Armstrong 520 Adhesive. Fittings are easily insulated with miter-cut pieces of Armaflex.

* **Recommended Armaflex thicknesses** for various service conditions are listed in a free, descriptive booklet. For your copy, write to Armstrong Cork Company, 2202 Sherman Street, Lancaster, Pennsylvania.

Armstrong INSULATIONS

Sound welds are the key to trouble-free installation. Here, 370 ft lengths of 1¼ in. Ammonoduct steel pipe, bent double, are being welded to nipples which are already weld-tight to 8 in. Bethlehem Electric Resistance-Weld steel pipe headers. *General Contractor:* Lawrence Plumbing and Heating, Inc., Baltimore, Md. *Pipe Jobber:* Southern Supply Company, Inc., Baltimore, Md.

NEW BALTIMORE ICE RINK DOUBLES AS A PARKING LOT

Located on the parking lot of Baltimore's Memorial Stadium, this huge field of pipe will soon be imbedded in concrete to become an 85 x 185-ft ice skating rink. In winter, skaters will waltz on the quick-frozen, hard-surface ice made possible by this top-performing refrigeration pipe, Ammonoduct.

And during the ball seasons, fans of the Orioles and Colts will park their cars *right on the rink!* The 54,000 feet of Ammonoduct steel pipe will help reinforce the concrete so that it will support a rinkful of cars.

Ammonoduct is best known as free-bending pipe for refrigeration service, pipe that can be bent cold without danger of fracture. But it has great strength as well. It's made of special quality open-hearth steel. And it is this steel strength of Ammonoduct pipe that has made the Baltimore rink-parking combination practical.

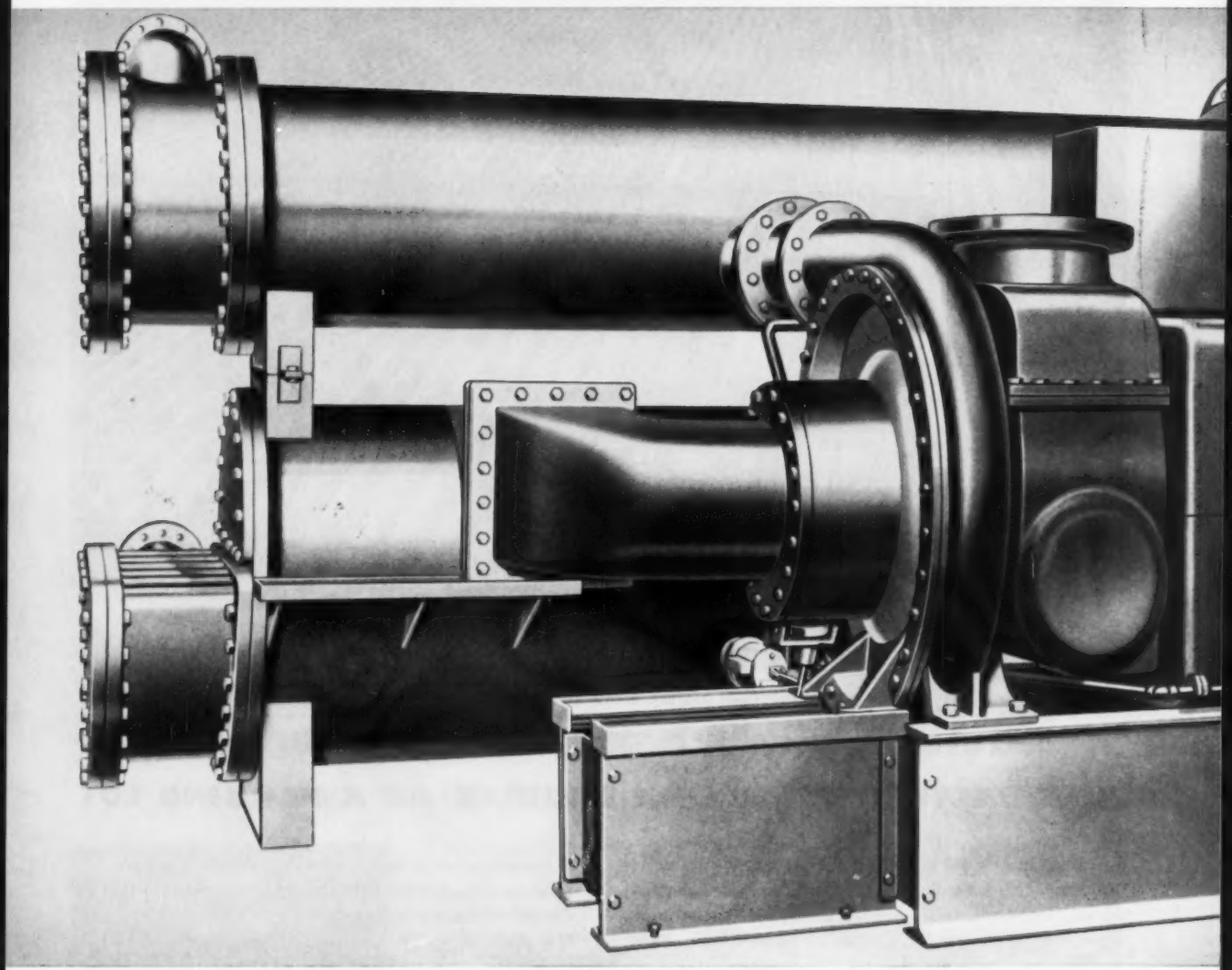
When you're looking for refrigeration pipe to perform double-duty service, look for steel pipe—ask your jobber for Ammonoduct.

It's top-quality pipe you can rely on.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

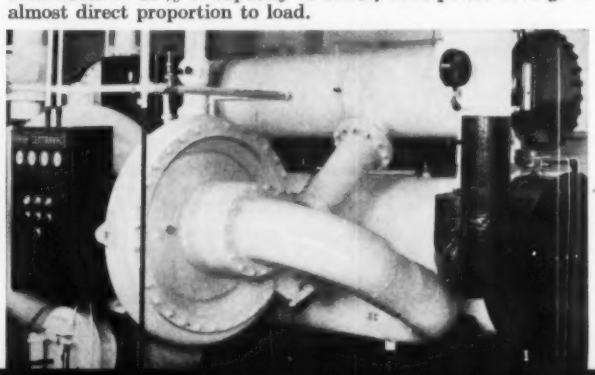
BETHLEHEM STEEL

TRANE ANNOUNCES
with

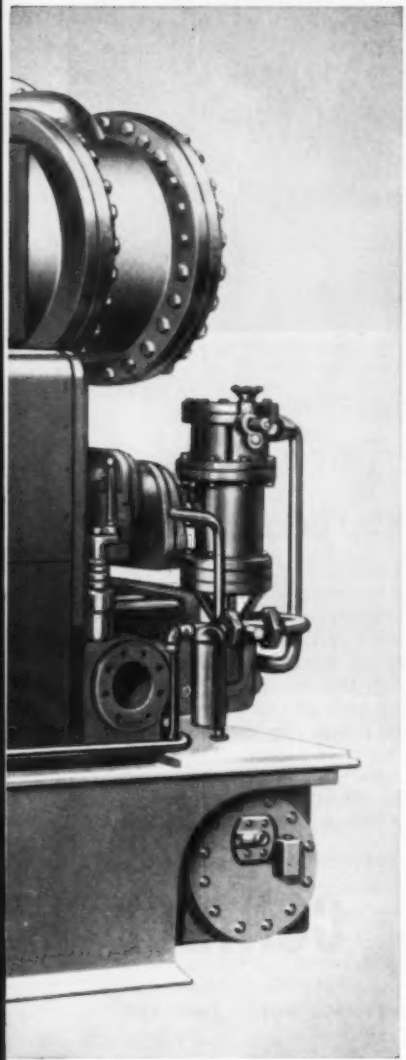


The Turbine CenTraVac reduces refrigeration costs to a minimum . . . brings new savings to plants and buildings where steam is available. Constant speed operation with prerotation vane capacity control improves performance at all part-load conditions. Compressor and turbine factory-assembled on a common base to eliminate field alignment problems. 300 to 1600 tons.

Hermetic CenTraVac water chiller with electric drive has been specified for more installations than all other makes combined! Modulates to 10% of capacity or lower, with power savings in almost direct proportion to load.



A CenTraVac® steam turbine drive



Now! Lower steam refrigeration costs, simplified installation with the Turbine CenTraVac—300 to 1600-ton water chillers.

Here's the first major advance in twenty years in the field of turbine refrigeration equipment! It's the TRANE Turbine CenTraVac, a centrifugal water chiller that combines the efficient CenTraVac compressor design with steam turbine drive—plus advantages not found in other turbine refrigeration units.

- **More efficient design.** Fewer moving parts. Impeller mounted on extended turbine shaft eliminates thrust and journal bearings.
- **Simplified installation.** Integral assembly of compressor and turbine eliminates critical field alignment problems.
- **Superior seal design.** Only ring collar of shaft seal rotates. Positive separation of oil and refrigerant.

Next time you plan an air conditioning system, consider the dependable TRANE Turbine CenTraVac. It's a complete water chilling system, simple in design, simple to install, quiet and vibration-free. It may be installed on any level surface, with no special bases. Wherever there is a supply of steam, it will provide new economy—with all the traditional quality and dependability of the hermetic CenTraVac.

Want more facts? Call your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

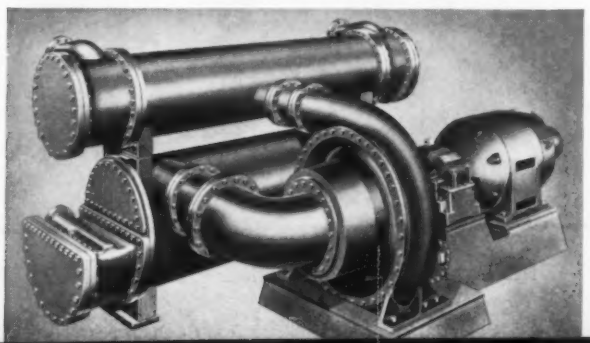
For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • SCRANTON MFG. DIV., SCRANTON, PA. • CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. • TRANE COMPANY OF CANADA, LIMITED, TORONTO • 97 U.S. AND 19 CANADIAN OFFICES

New Open CenTraVac, designed to meet all types of drive requirements, provides low operating costs. Pressurized lubrication and simplified, easily accessible shaft seal assure many years of trouble-free performance. For use with R-11.



Individually controlled UniTrane units filter all the air. Fan-coil and induction units available for floor, ceiling and concealed installation. New low-silhouette induction unit (illustrated) fits under low windows.

National Wax Company, Skokie, Illinois, designed and built by Ragnar Benson, Inc., Chicago. O. A. Wendt Co., mechanical contractor, Chicago.

New Wax Plant Makes Varied Use of Pneumatic Control System

At the new National Wax Company plant in Skokie, Illinois, Johnson Pneumatic Controls provide flexible, precise regulation of process steam, hot water and air conditioning as well as of the comfort air conditioning, heating and ventilating systems. The photographs on the opposite page show examples of how this specially planned Johnson System solves the diversified control problems involved in producing petroleum waxes for the food and container industries.

Johnson has installed thousands of pneumatic control systems to meet the specialized requirements of industrial users. Johnson Pneumatic Controls are applied to all types and makes of air conditioning, heating, cooling and ventilating equipment and to a wide range of processes.

Besides providing reliable, high-accuracy control, a Johnson System offers important economic advantages. For example, pneumatic controls are simpler, have fewer components, are easier to understand and operate and require less supervision and maintenance than anything else you can use. Power consumption is but a fraction of that used by other types of controls. And, Johnson equipment does not require the type of periodic maintenance-replacement program that eventually replaces the system. *Your clients pay only once* for, given ordinary care, a Johnson System can be expected to last for the life of the building.

Next time you have a control problem, have a nearby Johnson engineer explain the advantages of performance and economy offered by a pneumatic control system. There is no obligation.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

R-1051
Static Pressure
Indicator-Controller

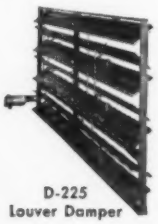
T-800 Remote
Bulb Thermostat

V-210 Three-Way
By-Pass Valve

T-400
Room Thermostat

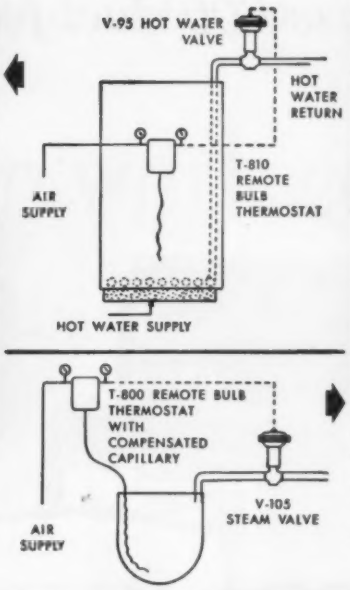
V-108
Three-Way
Mixing Valve

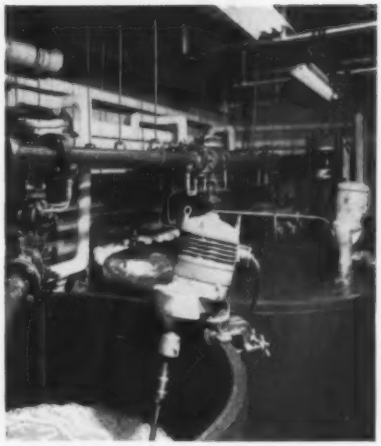
V-530 Precision
Pilot Positioner
applied to valve



D-225
Louver Damper

Tank Farm. Temperatures in twenty 12,000-gallon tanks for storing petroleum waxes are individually controlled by Johnson Thermostats and Valves. Wax is delivered in tank cars, heated to liquid form and piped in through heated lines.





Compounding. Ingredients are mixed in kettles containing up to 3,000 gallons. Kettle temperatures are controlled by Johnson Remote Bulb Thermostats which modulate Steam Valves to maintain a constant condensate return temperature.

Slabbing. Johnson Controls regulate the cooling system for the slabbing room where overnight 40 tons of hot wax are cooled to 40F for packaging in solid form. An economizer control arrangement cuts cooling costs by utilizing outdoor air instead of mechanically cooled air whenever possible.

Comfort Controls. The Johnson System assures an ideal working environment, includes individual room control of the office section air conditioning. Night setback feature keeps costs down. Shown at his desk is J. M. Packel, National Wax Company president, with W. J. Noll, traffic manager.

Johnson makes the most complete line of pneumatic control equipment for solving any problem of temperature, humidity and pressure control. Equipment includes thermostats, recorder-controllers, valves, dampers, damper operators, pressure regulators, humidostats, humidifiers, thermometers, switches, special controllers and related apparatus.

Complete engineering, sales and service facilities are available through 105 direct branch offices in the United States and Canada.

V-153 Sylphon Diaphragm Valve

D-251 Piston Damper Operator

T-1000 Recorder-Controller

JOHNSON SERVICE COMPANY
507-B East Michigan St., Milwaukee 1, Wisconsin

Please send me a condensed catalog of Johnson equipment.

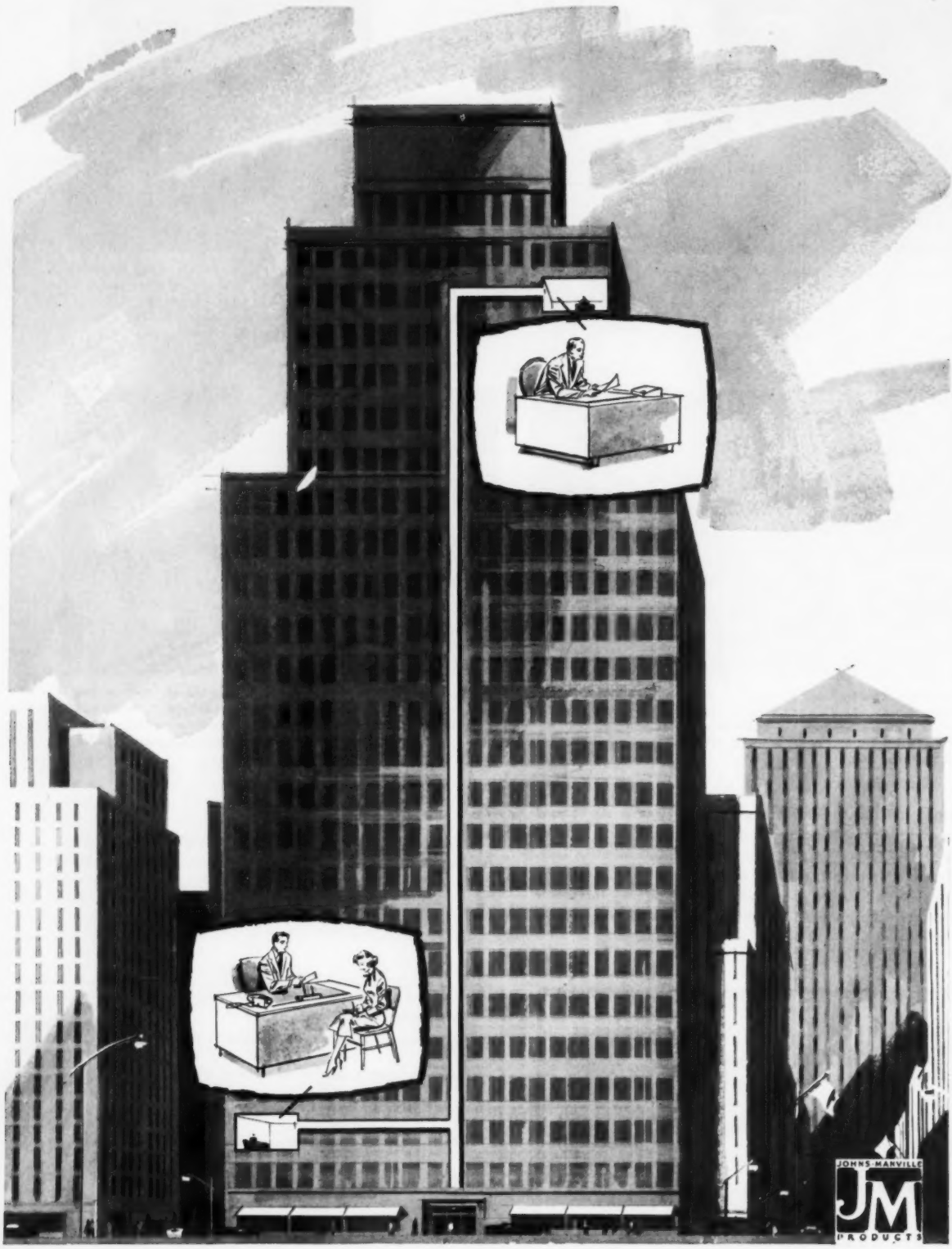
Name & Title_____

Firm_____

Address_____

City & State_____

Mr. Smith is 600 duct feet farther from



the fan room than Mr. Jones, yet . . .

both men work comfortably at the same temperature!

when ducts are *fitted square and tight* with Johns-Manville semi-rigid Spintex Insulation

SEMI-RIGID SPINTEX® works two ways to lessen heat loss, stop condensation: first, with low conductivity . . . then, with its square, tight fit. The structural strength of this material, which is fastened snugly to duct surfaces with pins and clips, prevents "ballooning" due to duct leakage. And butted or mitred joints eliminate stretching and thinning of the insulation at corners. Instead, there's a full thickness of Spintex—with full protection against heat loss and condensation—over the *entire duct area.*

This two-way "edge" in insulating effectiveness is the big reason why leading engineers everywhere specify semi-rigid Spintex . . . for factories, institutions and office buildings of every description.

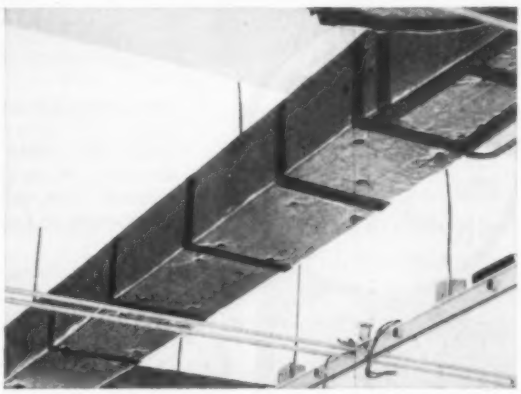
LESS HEAT LOSS...NO CONDENSATION AT CORNERS!
Semi-rigid (not flexible) Spintex fits squarely and tightly all duct surfaces. Stretching and thinning at corners, unavoidable with wrap-around insulations, are eliminated completely. Instead, Spintex retains full thickness everywhere to stop heat loss and condensation. Its structural strength prevents "ballooning."

FACED FOR ANY SPECIALIZED NEED!
J-M offers you a facing to meet any vapor condition, incombustibility requirement or decorative need. Provides good base for plaster finish . . . or where no facing is indicated, Spintex presents an attractive appearance with trim, tidy joints.

INSTALLS QUICKLY . . . ECONOMICALLY.
Spintex is clean, sanitary and "friendly" to handle. It cuts readily with an ordinary knife. Installs quickly, easily, even when ducts are curved or in difficult-to-reach areas.

Produced by a new Johns-Manville spinning process, today's Spintex offers more insulating value than ever. Its mineral fibers are smaller in diameter, and substantially more uniform. This improved fibrous structure adds countless heat-blocking dead-air spaces per cubic inch to help keep working temperatures precisely the same throughout the structure . . . with minimum operating costs!

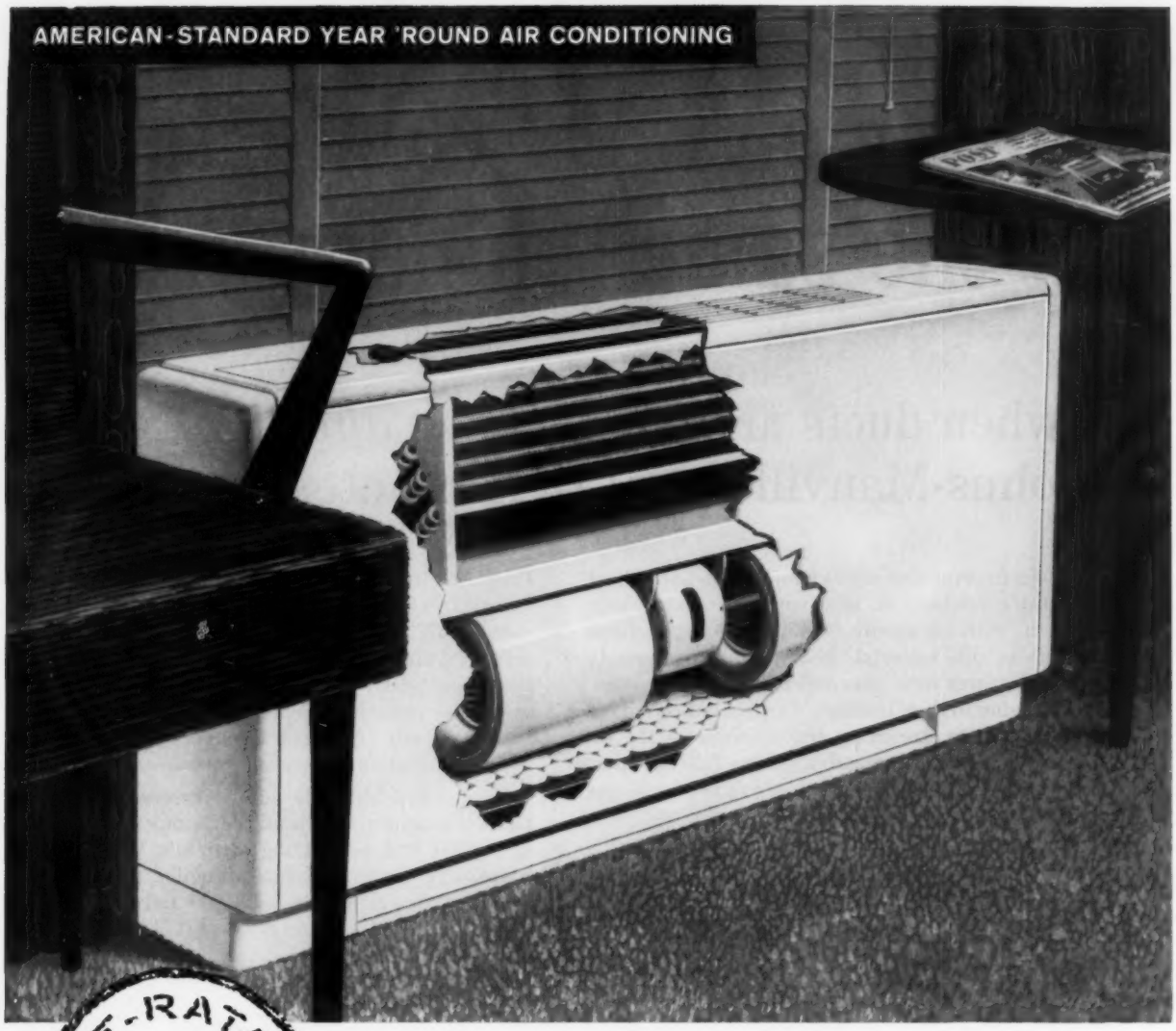
Your Johns-Manville sales representative will be pleased to send you information, along with samples of Spintex and J-M facing materials. Why not call him today. Or write Johns-Manville, Box 14, New York 16, N. Y. In Canada, 565 Lakeshore Road East, Port Credit, Ontario.



AIA FILE NO. 37-D-1-2

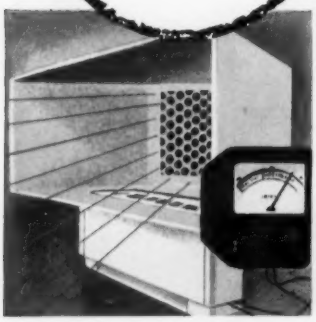
JOHNS-MANVILLE

AMERICAN-STANDARD YEAR 'ROUND AIR CONDITIONING

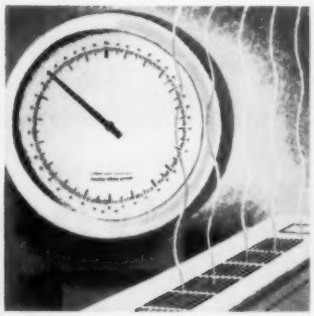


TEST-RATED by AMERICAN-Standard

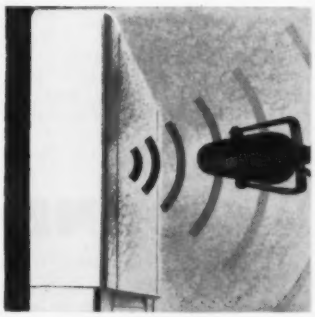
The Units: All units are a space-saving 9″ thin and 25″ low with individual room unit control for complete operating flexibility. They're available in three convenient models and four practical sizes, either recessed or free-standing. Remotaire units are exceptionally quiet because of slow-speed motors (1050 rpm max.), large coil surface and filter area, heavy insulation, no reactors or autotransformers.



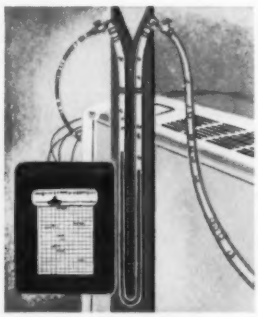
Tested for Air Capacity



Tested for Thermal Capacity



Tested for Quietness

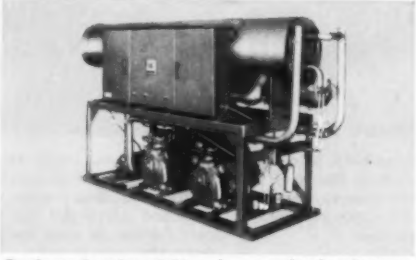


Tested for Humidity Control

AIR CONDITIONING

can deliver right up to its ratings— the Type 20 Remotaire proves it!

New A-7 cast iron boiler features exclusive optional steel pedestal base that eliminates need for pit or fire brick base. Sections tested at 2½ times normal operating pressure. Oil or stoker firing. I-B-R outputs of 866 to 2148 MBH.



Packaged water chiller is completely factory-assembled. Refrigerant circuit piped, control panel wired and entire unit tested. No field assembly needed. Available in complete range of sizes, from 7½ hp to 125 hp.

Here is a year 'round system with room units that deliver heating and cooling right up to their maximum ratings. American-Standard Remotaire units are thoroughly proved in rigidly controlled tests. Precise measurement is made of thermal capacity, water flow, pressure effects, condensate control, operating sound level, humidity limit and electrical characteristics. Each unit bears the U.L. Re-examination Service marker.

The System: Type 20 Remotaire is part of a hydronic system in which one set of small-diameter, flexible, space-saving pipes carries hot water for heating or chilled water for cooling from a boiler-chiller team to room units.

For full description and simplified capacity selection tables, see your American-Standard representative or write AMERICAN-STANDARD, PLUMBING AND HEATING DIVISION, 40 W. 40 St., New York 18, N. Y.

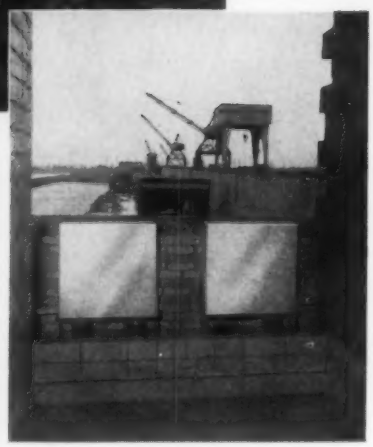
AMERICAN-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation

AMERICAN-Standard
PLUMBING AND HEATING DIVISION

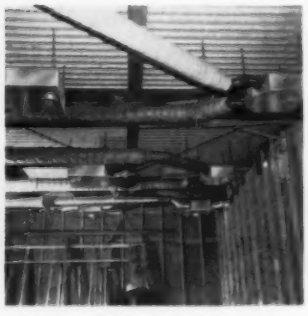
On the waterway

Aerial view of the Robert H Saunders—St. Lawrence Generating Station, in which a Connor High Velocity system provides "constant comfort conditions."

Some of the 131 Under-Window units installed here. Because of the highly efficient way in which it blankets the cold outer walls with warm air, this attenuator is ideal for the climate, where cold wind, ice, and snow vigorously bear in upon the buildings much of the time.



Under-Window units, two of which are shown here partially installed, produce a draftless air flow pattern upward along the wall and out under the ceiling, effectively conditioning an area approximately 25 feet from the outside wall.



Other Connor products are used too. In the lobby of the administration building, and elsewhere, Connor Square Overhead Air Diffusers provide positive and properly balanced air distribution . . . and integrate perfectly with the rectangular pattern of the decor.

Part of the vast network of Connor Dual Duct Attenuators. The high velocity system conserves valuable space and provides optimum zone control.

that broke the land barrier...

CONNOR delivers High Velocity Air . . . and meets architectural and engineering demands with their exclusive Removable Under-Window Units.

On the new and gigantic St. Lawrence Power Project, it was necessary to "harness the river" for the combined reasons of commercial advantage and increased power resource.

And so was it necessary to harness air . . . to ensure constant comfort conditions within Ontario Hydro's Robert H. Saunders—St. Lawrence Generating Station.

Connor Under-Window Model Valve Attenuators installed here represent important new dimensions for today's architect in his effort to combine function and decoration effectively.

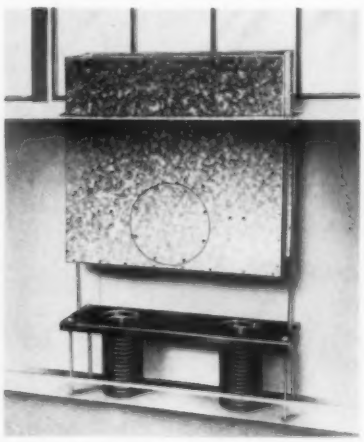
The unique design of these Under-Window units permits their removal through a top discharge grille. And this single design feature—offered exclusively by Connor —was eminently beneficial to the architect in two totally unprecedented ways:

It enabled him to specify special materials for the interior walls and window ledges . . . providing the interior with an uninterrupted, flowing decorative pattern.

It freed him from the worry that the solid glazed tile walls and ledges might later have to be dismantled to provide the enclosed equipment with the service that any moving mechanism may require.

Additionally, these Under-Window units satisfied several special engineering demands for balanced air delivery, zone controlled air diffusion, and space conservation.

Demonstrated here is the way in which the Under-Window units are permanently enclosed by the glazed tile wall and ledge.



Ease of installation and removal. The units are simply inserted or removed through the grille opening at the top, and clamped (when installing) to mounting plates.

Like the other attenuators in Connor's complete line, this unit is equipped with highest quality components and engineering features which include the Helical Spring Damper for complete close-off and sinuous baffle for exceptionally quiet operation.

CONNOR... for Constant Comfort Conditions

Request our new Bulletin K33-A. It provides complete information and technical data on Connor's complete line of high velocity equipment.

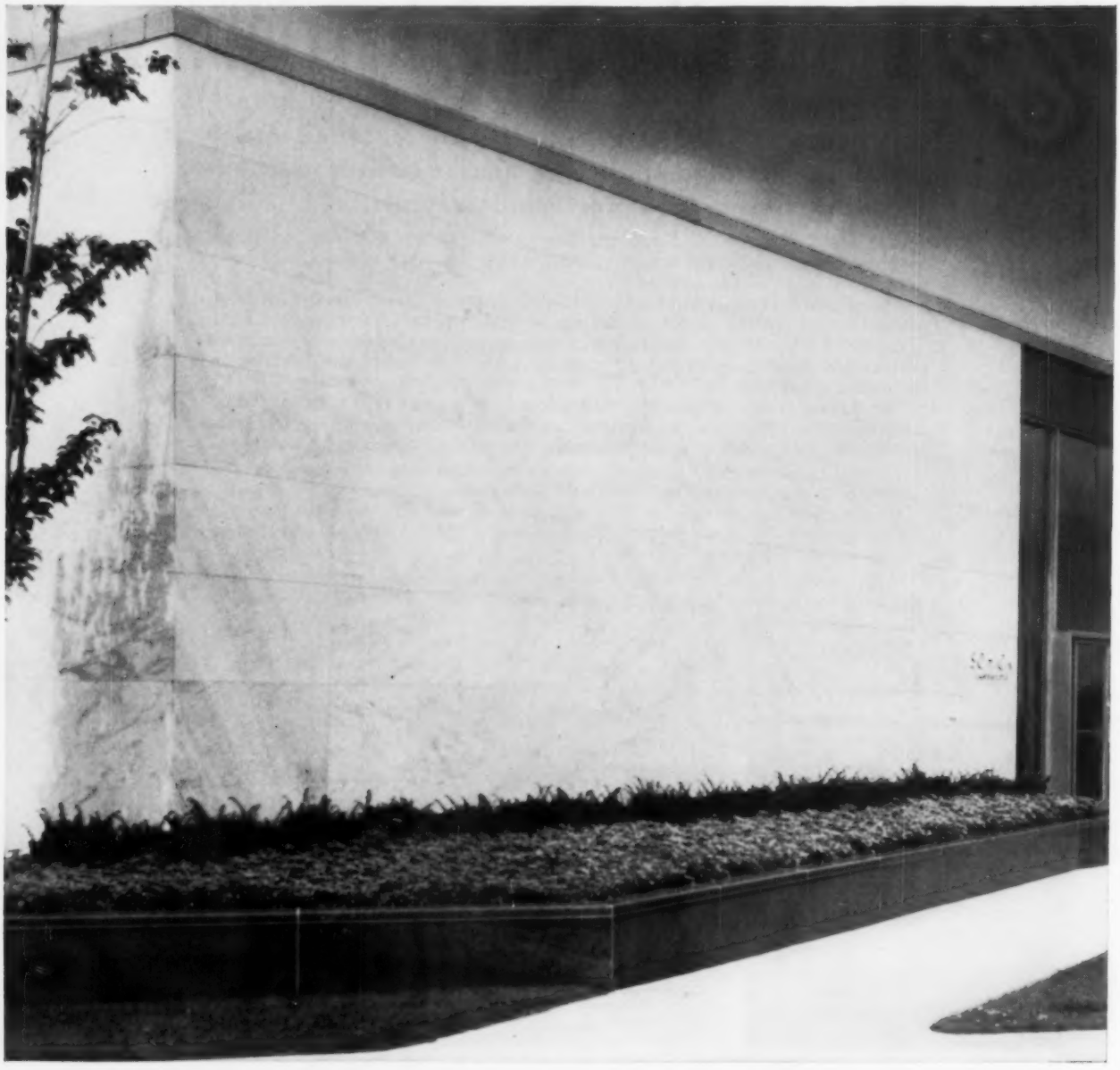
CONNOR ENGINEERING CORPORATION

DANBURY • CONNECTICUT

CONNOR ENGINEERING CORPORATION

kno·draft®

high velocity air diffusers



"We get all-year humidity control at low cost...thanks to GAS-operated CARRIER absorption refrigeration"

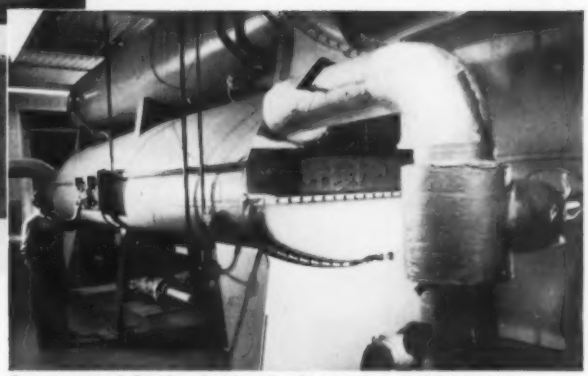
Thomas M. Garry, Schick Incorporated

VICE-PRESIDENT OF MANUFACTURING

"We needed refrigeration equipment which would give exact humidity control all year 'round to minimize rusting of the highly-polished parts used in making shaving heads. Our 595 ton gas-operated Carrier Absorption Refrigeration unit does the job with top efficiency... and provides comfort cooling for the entire plant at low operating costs."

The Carrier Absorption unit uses ordinary tap water as a refrigerant. No prime mover is required, only low pressure steam or hot water. Seasonally idle boilers can be put to use all

Pioneer producer of electric shavers, Schick Incorporated, occupies this modern, efficient, and completely air-conditioned building in Lancaster—heart of the Pennsylvania Dutch country.



Gas-operated Carrier Automatic Absorption Refrigeration

- cuts operating expenses
- minimum maintenance required
- low installation cost
- adjusts automatically to cooling load
- compact and light weight

year around...and with gas as the boiler fuel, operating costs are cut to a minimum. Low maintenance is another substantial savings, since there are no major moving parts to get out of order, need replacing or repair.

Because of low installation, operating and maintenance costs, the gas-operated Carrier Automatic Absorption units can be the source of important savings. For full details, call your local gas company, or write to the Carrier Corporation, Syracuse, New York. *American Gas Association.*

Engineering the temperature...

with a ONE PIECE, 233 TON Evaporative Condenser. Factory assembled and shipped as a unit, the compact DF-41A is only 93" high, 96" wide and 247" long.

RECOLD **CORPORATION**
7250 East Slauson Avenue, Los Angeles 22, California

RECOLD

FREE BOOK helps you get the most from...

Republic ELECTRUNITE Stainless Steel Tubing and Pipe

Do you know the corrosion-resistance properties of stainless steel tubing and pipe? Do you have a handy reference of weights and bursting pressures? This free 60-page book gives you these facts and more . . . helps you get the most from Republic ELECTRUNITE® Stainless Steel Tubing and Pipe.

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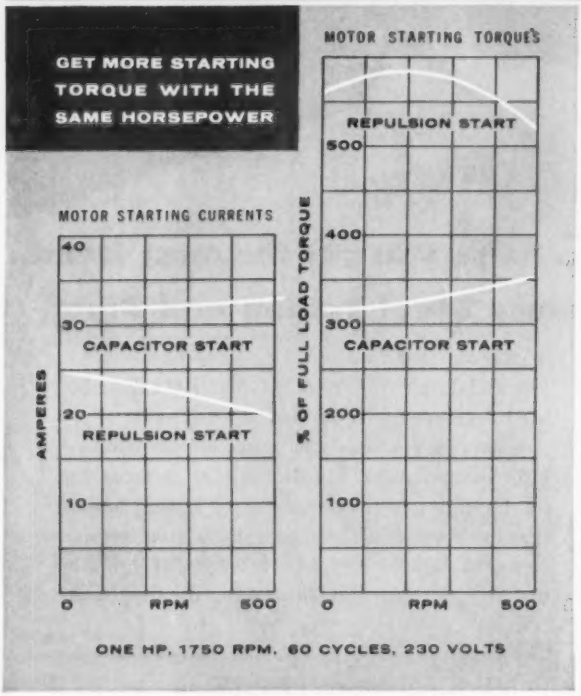
TOUGH STARTS MADE EASY...

WAGNER REPULSION-START INDUCTION MOTORS



START HEAVY LOADS WITH EASE

STAND UP UNDER LONG SERVICE

USE EXTREMELY LOW STARTING CURRENT

Starting heavy loads is a natural for Wagner Type RA Motors. Widely used for high starting torque applications, like farm machinery, compressors, pumps and grinders, this rugged single phase motor requires very low starting current that minimizes light flicker. You get smooth performance with a constant high operating speed, even under overload, and a flat efficiency curve over a wide operating range.

You practically eliminate service problems when you power tough single phase applications with these motors. They have unmatched ability to start high inertia or heavy friction loads repeatedly and they give many years of unfailing service.

You can get these motors from leading motor distributors in your community or through Wagner Sales Offices in 32 principal cities. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-220 gives full details on Repulsion-Start-Induction Motors.

WM59-8

Wagner Electric Corporation

6370 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

SERVING 2 GREAT GROWTH INDUSTRIES . . . *ELECTRICAL . . . AUTOMOTIVE*

LADISH

Controlled Quality

LIGHT WEIGHT
WELDING NECK
FORGED FLANGES
125 POUND

TO MARK PROGRESS

Reduce cost... eliminate breakage of cast flanged-end piping components when bolting to steel welding neck flanges

POSITIVE, LEAK-TIGHT JOINTS

Proven design principle of raised face flange has been adapted to assure a completely safe, positive connection to class 125 cast iron flat face flanges.

ELIMINATES NEED FOR HEAVY FLANGED ENDS ON VALVES AND PUMPS

No longer is it necessary to pay a premium to obtain the heavier flanged end valves, pumps and other piping components required to withstand bolting to raised face steel flanges in a welded piping system.

LOW WEIGHT—AMPLE STRENGTH

Light cross section design reduces weight to 30-50 per cent of ASA 150 pound Welding Neck Flange . . . still possesses ample strength to assure safe, leak-tight joint with mating cast flange.

LOWER COST

Savings in purchase price of Light Weight flanges are supplemented by additional savings realized by selecting valves on the basis of pressure rather than strength characteristic of flanged ends.

EASE OF INSTALLATION

Adequate welding neck type hub length keeps welding heats safely from flange. Prevents unpredictable warpage and deformation. Light weight facilitates handling, speeds positioning and installation.

MINIMIZES PIPEFITTER PRECAUTIONS

Safe and suitable for use with either carbon or alloy steel bolting . . . either full face or ring gaskets, in 1/16" or 1/8" thicknesses.

PRESSURE-TEMPERATURE RATING

Rating corresponds to ASA B16.1 class 125 cast iron flanges . . . 125 PSI (gauge) saturated steam; 175 PSI (gauge) water, oil or gas at 150° F.

SERVICE APPLICATIONS

Widely accepted for low pressure piping in gas distribution service . . . utility services such as water, heating, air conditioning, refrigeration . . . pumps and compressors.

PIPING PROBLEM:

(1) Difficulty experienced in making pressure tight connection with flat face flanges with full face gaskets.

(2) Breakage of relatively brittle cast iron flanged ends on valves, pumps and other piping components when bolted to standard 1/16" raised face steel flanges.

LADISH SOLUTION:

The 125 pound Light Weight flange developed by Ladish is an ideal solution to this problem . . . for not only does it solve the problem . . . but it provides significant additional advantages of cutting purchase costs and reducing weight.

You can depend on Ladish for leadership in introducing piping developments to reduce cost and improve service.

A national network of distributors, Ladish plants and sales offices is ready to serve you.

Specification sheets on Light Weight Flanges and Welding Fittings available on request.

TO MARK PROGRESS

LADISH CO.

CUDAHY (Milwaukee Suburb) WISCONSIN

SALES OFFICES: Amarillo • Atlanta • Baton Rouge • Buffalo • Calgary
Chicago • Cincinnati • Cleveland • Denver • Havana • Houston • Los Angeles
Mexico City • Montreal • New York • Odessa • Philadelphia • Pittsburgh
St. Louis • St. Paul • San Diego • San Francisco • Seattle • Toronto • Tulsa

SAW BLADES • PIPE FITTINGS • DROP FORGINGS • RINGS • VALVES

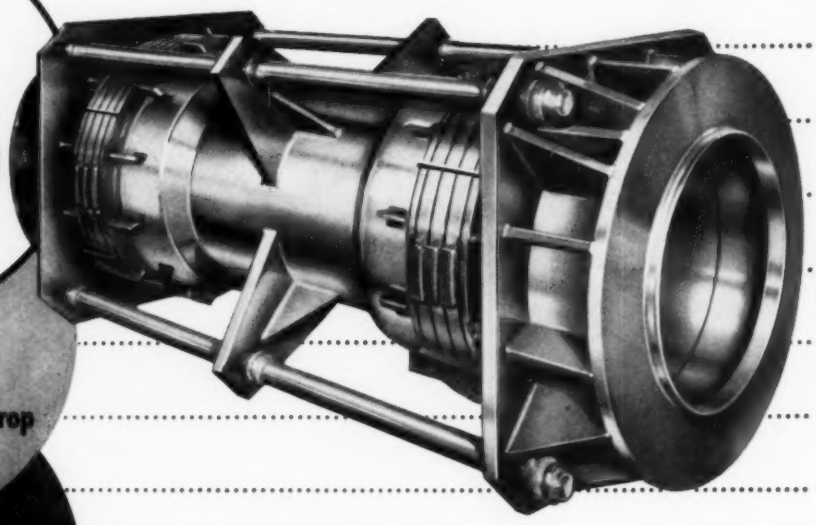
LADISH...THE FITTINGS LINE THAT OFFERS COMPLETE SERVICE IN TYPES, SIZES AND MATERIAL SPECIFICATIONS

WELDING FITTINGS	ASA & MSS FLANGES	SCREWED & SOCKET FITTINGS & UNIONS	LONG NECKS	LARGE DIAMETER & T.E.M.A. FLANGES

for Piping Protection Plus

+ lower heat loss
+ minimum space
+ lower pressure drop
+ minimum cost

Specify ADSCO



CORRUFLEX®

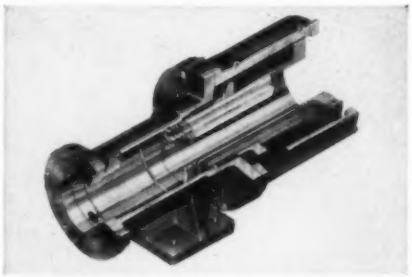
PACKLESS EXPANSION JOINTS

Designed for a 30" diameter high pressure, high temperature service line in a southwestern aircraft and missiles engine test center, the Adsco CORRUFLEX Self-equalizing stainless steel Expansion Joint shown above is one of many custom-designed units in service.

Adsco CORRUFLEX Expansion Joints are manufactured in sizes of 3" or larger, designed for specific line conditions. These units provide maintenance-free, trouble-free service.

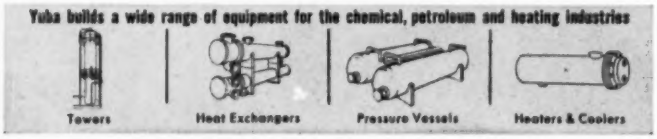
Every possible combination of pipe motion can be fully compensated for – absorption of axial motion, lateral deflection and angular rotation – with one or more standard or custom-engineered CORRUFLEX packless joints built by Adsco.

For complete engineering data write for your copy of the new CORRUFLEX Expansion Joint Bulletin, No. EJ-59-50 on your company letterhead.



ADSCO Piston-ring Slip-type Expansion Joints are world renowned as the only joints which can be unpacked and completely repacked without shutting down line pressure. As the *only* manufacturer of both slip and packless expansion joints, Adsco recommends the proper type which is best suited to the demands of the job – your assurance of complete satisfaction, utmost economy.

Yuba builds a wide range of equipment for the chemical, petroleum and heating industries



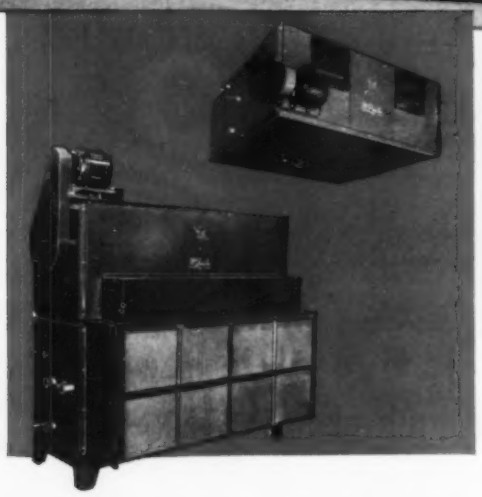
Adsco Division • 20 Milburn St., Buffalo 12, N. Y.

YUBA CONSOLIDATED INDUSTRIES, INC.

YUBA Plants and Sales Offices NATIONWIDE

a Monument to PERSHING
a Monument to AIR CONDITIONING
BY McQuay

Pershing Municipal Auditorium, Lincoln, Neb.
Architects: Davis & Wilson, Lincoln
Consulting Engineer: William Cassell, Kansas City, Mo.
Mechanical Contractors: Nathin & Co., Lincoln.



The Pershing Municipal Auditorium is a showplace in Lincoln, Nebraska. It is a monument to General Pershing and a monument to air conditioning. Thirteen McQuay Seasonmaster units and ten McQuay water coils provide year 'round air conditioning for this modern structure. To be sure that your next air conditioning job functions at its very best, see your McQuay representative. He will be glad to assist you in any air conditioning heating or refrigeration problems you may have. McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

McQuay Horizontal and Vertical Seasonmaster central station air conditioning units. They are available with water coils, steam coils or direct expansion coils. Removable panels permit complete accessibility for inspection or service. All Seasonmaster units are made with the exclusive McQuay Ripple-Fin coils. Seventeen sizes available. Range from 640 cfm to 38,000 cfm.

McQuay Means Quality

McQuay units feature the exclusive Ripple Fin Coils which create maximum air turbulence and have wide, full fin collars that act as automatic spacers to form a tube around the coil tube for greatest heat transfer and protection. Dura-Frame "V" channel construction provides the strength and rigidity necessary for quiet, trouble-free operation.

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

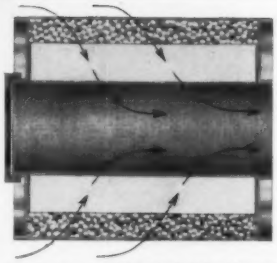
NOW... Split-Second Handling
With the New Type 75
HENRY MULTIPLE
CARTRIDGE DRIERS
PATENT PENDING
FLOW
An efficient and high capacity multiple cartridge filter-drier with a drying and flow capacity range up to 125 tons.

Low Pressure Drop...No By-Pass Required

875-CMS DRI-COR® Filter-Drier Cartridges for these new driers are self-sealing and self-positioning. It requires only a few seconds to insert the cartridges into the drier shell, resulting in a minimum of exposure to the atmosphere and loss of cartridge drying capacity. Thus, the cartridges are clean, dry and complete—due to efficient design and split second handling.

The refrigerant flows uniformly over the total cartridge surface, through the desiccant bed and each filter core. This results in maximum moisture and acid removal with high flow capacity and low pressure drop.

These brass driers contain from two to five cartridges and are available with connection sizes ranging from 1⅛" to 2⅛" O.D. Solder.



CAT. No. 875-CMS DRI-COR® FILTER-DRIER CARTRIDGE WITH

1. OUTER PERFORATED BRASS SHELL.
2. BED OF GRANULAR MOLECULAR SIEVES.
3. CERAMIC FIRED DESICCANT FILTER CORE.
4. INNER DUTCH WEAVE MONEL SHELL.
5. PROGRESSIVE FILTRATION.
6. ONE SIZE CARTRIDGE FOR ALL TYPE 75 DRIER SHELLS.

HENRY VALVE CO.

MELROSE PARK, ILLINOIS (Chicago Suburb)

Cable: Hevalco, Melrose Park, Illinois

VALVES, DRIERS, STRAINERS AND ACCESSORIES FOR REFRIGERATION, AIR CONDITIONING AND INDUSTRIAL APPLICATIONS

HENRY VALVE CO. CONTROLLING FLOW SINCE 1914

FRICK TRADE MARK®

Air Conditioning & Refrigeration

Serving the Great BARNES HOSPITAL . . . WASHINGTON UNIV. MEDICAL CENTER at St. Louis, Mo.

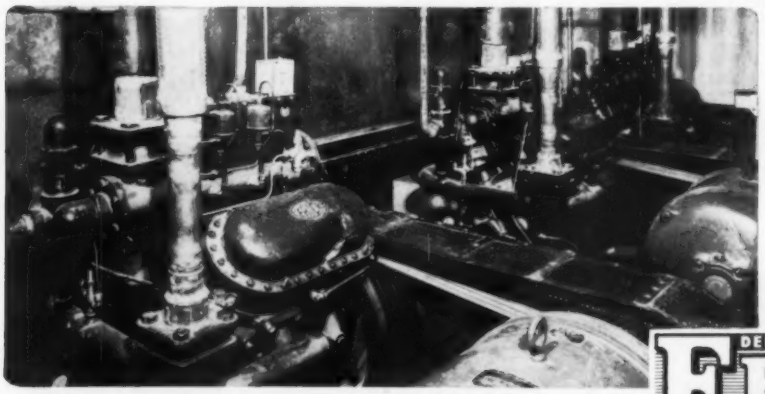
7½-Ton Frick unit air conditioner serving four research and lecture rooms.

Here 11 Frick unit air conditioners and 42 Frick compressors supply the necessary cooling services for operating rooms, private rooms, auditorium and chapel, class rooms, nurse-interns' dormitories, offices, libraries, laboratories, cafeterias, kitchens, special freezers, research departments, morgues, animal rooms, etc. Installation by L. V. Fleiter Co., Inc., Frick Distributors in St. Louis, Missouri.

Whether you need conditioned air, cold water, ice, cold rooms, or very low temperatures,—for human comfort, food service, process work, quick freezing, research, or any other commercial or industrial purpose,—there's a Frick system to meet your exact requirements.

Let us quote now on the equipment you need.

Write . . .
wire . . . phone or visit.



Three Frick "ECLIPSE" compressors which air condition several operating rooms at Barnes Hospital, St. Louis.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
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Skidmore Pumps

Here are the answers to— your Heating Pump Problems

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CCVS

Here's the NEW Skidmore CCVS Vertical Pump — offering [illegible] high pump efficiency — yet with a minimum motor size [illegible] ing new Close-coupled design and mechanical shaft [illegible] seal . . . complete pump and motor unit is bolted to receiver . . . in size for all installations: Three new single units and two duplex units . . . can be installed on floor level or in pit. Write for your copy of new bulletin No. 21-C which fully describes these new, rugged, compact CCVS Skidmore Pumps.

This NEW single unit above has a 6000 sq. ft. EDR with 10 gallon receiver

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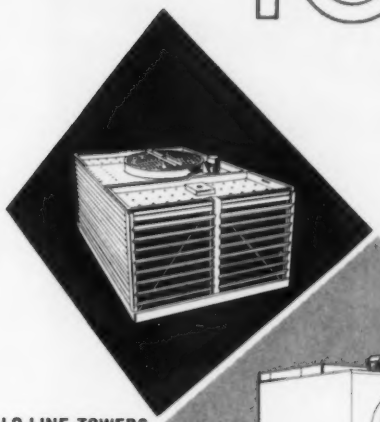
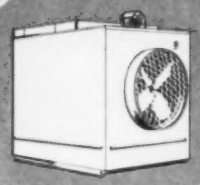
TOWERS TOWERS TOWERS

smallest to the LARGEST
Now Pritchard makes 'em all

From two tons up. That's the extent of Pritchard's line of cooling towers. Reason? Merger with Dover Mfg. Co. That added Dover's "packaged" towers to Pritchard's famous Lo Line series. Now, whatever your water cooling job, Pritchard has a tower that will exactly fit your requirements—in capacity *and* price. Write for catalog details.

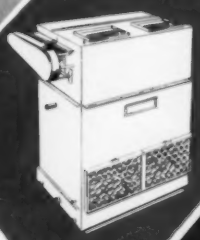


LO-LINE TOWERS
Big capacity plus a low silhouette make these towers favorites for commercial air conditioning. Wood and fire-code models.

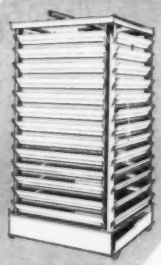


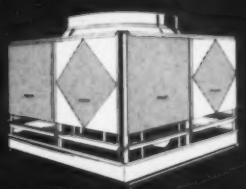
VERTICAL TOWER
So quiet it can be used indoors. Shipped factory-assembled for fast installation.

CROSS-FLOW "PACKAGED" TOWER
Hot-dipped galvanized after fabrication. Shipped assembled for fast, easy installation. Quiet.



PANELRAMIC TOWER
Exclusive colored panel feature permits tower to be used as company identification sign, or as distinctive design element of building.





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Economical way to handle water from small capacity systems. Sets up in 20 minutes, gives years of maintenance-free service.

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Please send catalog details on:

- ☐ LoLine Towers
- ☐ Cross-Flow Packaged Towers
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Wolverine Trufin is available in Canada through the Unifin Tube Division, London, Ontario.

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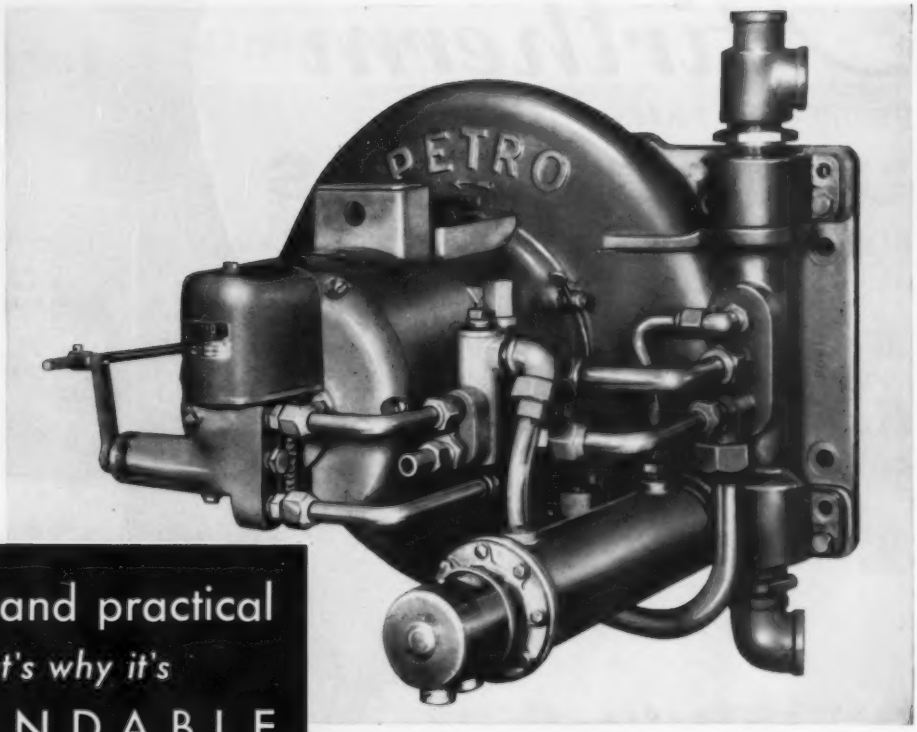
Manufacturers of Quality Controlled Tubing and Extruded Aluminum Shapes

Petro HEAVY OIL BURNER



Simple and practical *that's why it's* DEPENDABLE

Residual oils are low cost fuels. They have higher heat value than light oils, and usually cost less per gallon. But in spite of their economy they are often avoided because they are considered difficult to handle and burn. A moderate change in temperature can change them from a fluid to a sluggish semi-solid.

These heavy oils (Nos. 5 and 6) are easily controlled and burned by the Petro system which is remarkably free from mechanical complexities.

1. A simple oil heater automatically warms the oil to a point where a common viscosity is reached. (Fuel oils approach this at a temperature of about 160 degrees).

2. An automatic valve passes the oil to the nozzle only when it is warm enough for accurate metering and instant ignition.

This is the basis of the Petro "Thermal Viscosity Principle." The Petro burner isn't fancy; it isn't temperamental; but it *stays on the job.*

In spite of its ruggedness, the Petro heavy oil burner is precision equipment which will operate efficiently with any type of automatic control system.

Petro oil burners have been the steady, reliable work horses in heavy oil firing for over 50 years. They have saved their owners untold thousands of dollars in low fuel and maintenance costs.

For further information, please mail coupon.

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Over 50 years of leadership in automatic heating and power equipment

PETRO, 3330 W. 106th St., Cleveland 11, Ohio
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Please send me literature and specification sheets on the money-saving Petro forced draft firing system.

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Airtherm

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UNIT HEATERS

FOR STEAM OR HOT WATER

A SIZE FOR EVERY REQUIREMENT

The new Airtherm line incorporates 22 completely redesigned vertical units and 24 improved horizontal units, ranging from 18,000 to 555,000 BTU per hour, with a choice of outlet diffusers to cover practically every air distribution pattern and mounting height. Silent operation is assured by resiliently mounted motors, properly designed fans and casings, and attention to face and outlet velocities. All fans are expertly positioned, balanced and tested. Each unit is tested and rated for performance in strict accordance with the Standard Test Code of the industry. Only brand name, continuous duty motors, especially made for the purpose, are used and mountings are designed for efficient cooling and easy servicing. Rugged coils are formed by hydraulically expanding copper tubing into plate type aluminum fins, each with its own collar, providing increased heat transfer and wide, even spacing to reduce clogging. All coils are tested and tagged for 500 p.s.i. hydrostatic pressure. Casings are phosphatized to insure a long, rust-free life for the attractive baked enamel hammer tone finish.

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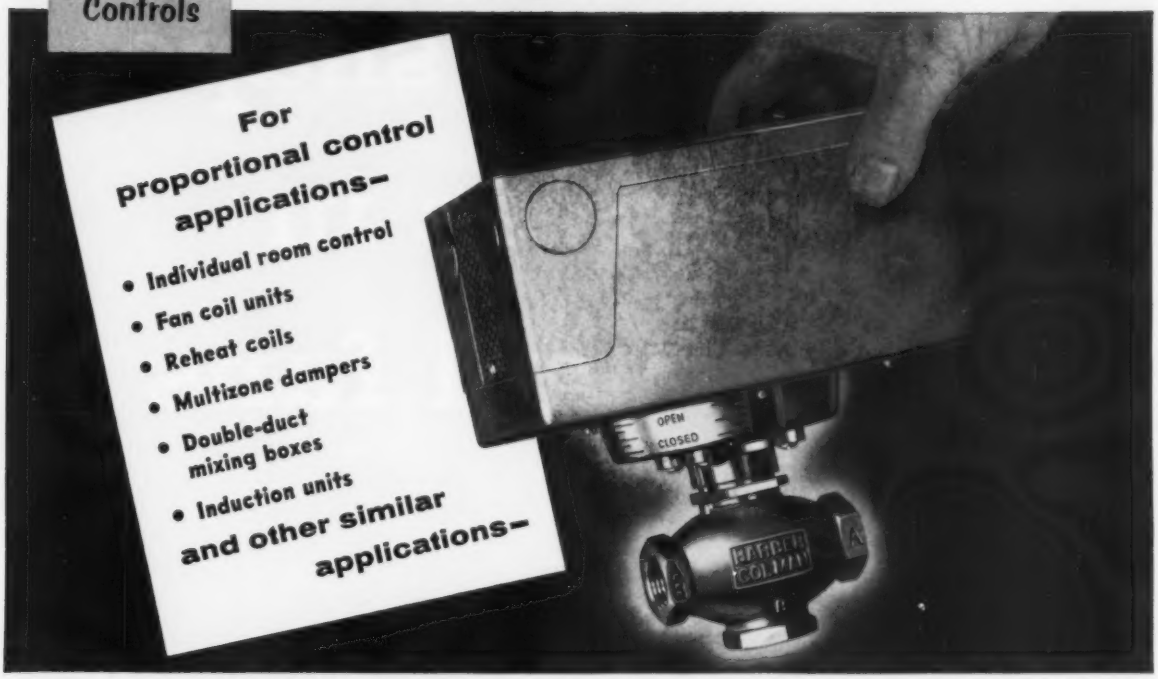
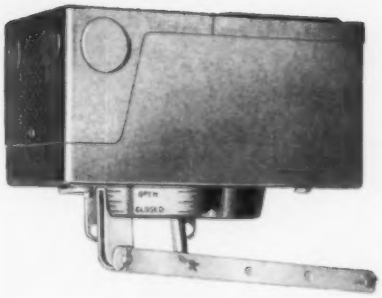
Automatic Controls

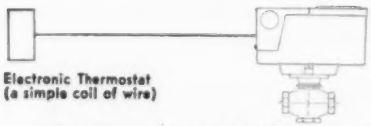
NEW!

A Transistorized Electronic Motor Operator





–with lever for air damper control



Schematic Transistorized Motor Operator (no tubes or relays)

Transistors eliminate tubes and relays giving you the benefits of electronic control at no extra cost

Now for the first time, electronic system control is available at a cost comparable with "standard commercial equipment."

The transistor operator is an electronically controlled device containing a transistorized amplifier and an operating mechanism designed for proportional operation of a valve or damper.

Virtually self-contained, the simple attachment of a two-wire sensing element to the operator forms a system of electronic control (see schematic).

Check these "plus features":

- Simplified, compact unit through the use of transistors.
- Long, trouble-free performance and low maintenance through the elimination of tubes and relays. All moving parts operate submerged in oil.
- Simplifies installation because of compactness and self-contained design.
- Spring return action provides fail-safe performance. Operator returns to "off" position in case of power failure.
- Operator can be easily converted from direct to reverse acting.

Call your Barber-Colman representative or write today for brochure F8991.

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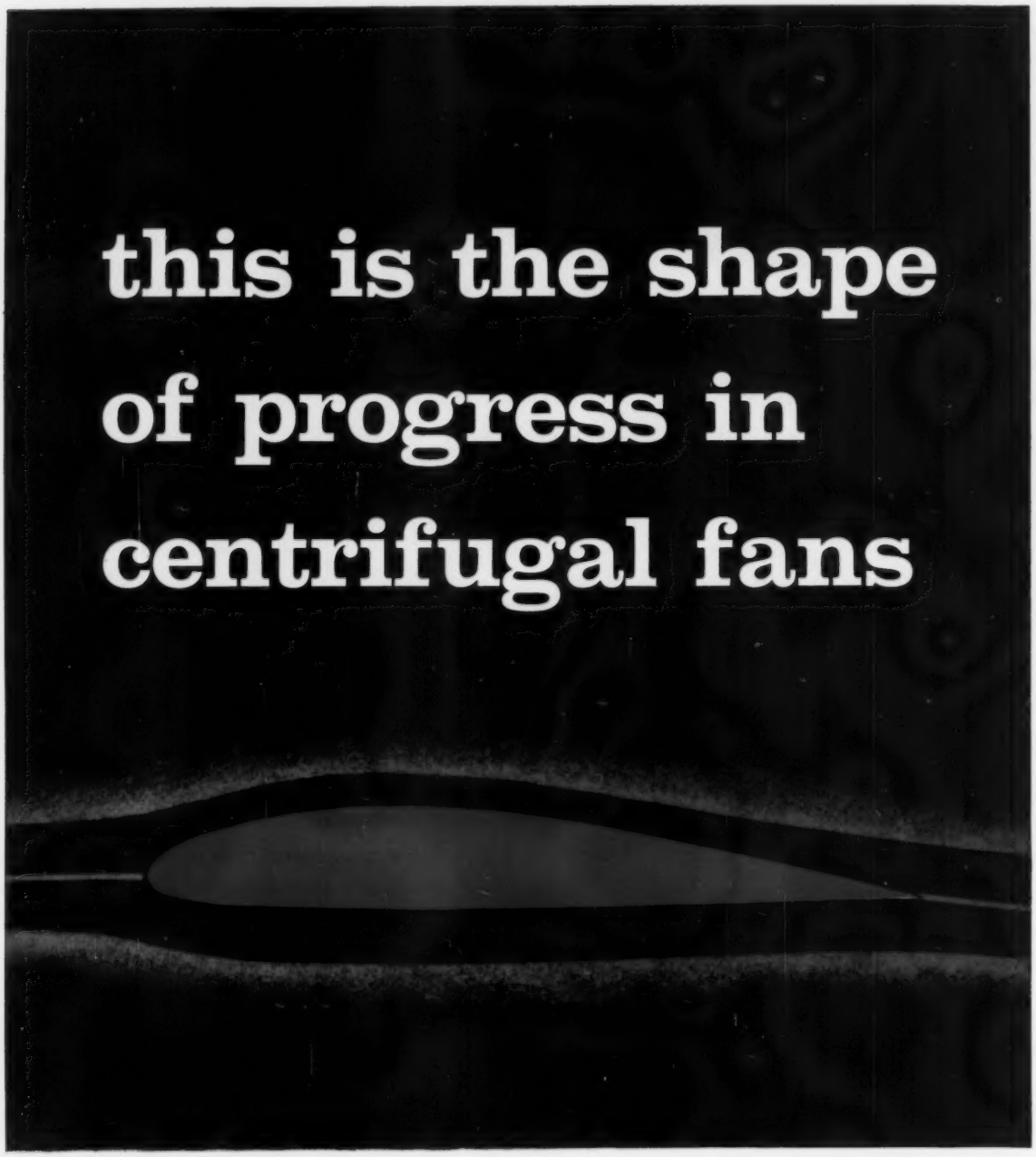

The Shape of Progress is—AIRFOIL!

Only Westinghouse offers *you* the effectiveness and quietness of Airfoil Blading in a complete line of centrifugal fans sized to AMCA (NAFM) Standards.

Westinghouse offers these *bonus benefits* in capacities up to 700,000 cfm and four AMCA pressure classes up to 16¾" pressure:

- **Lowest Operating Cost**
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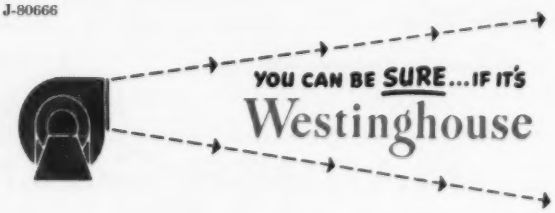
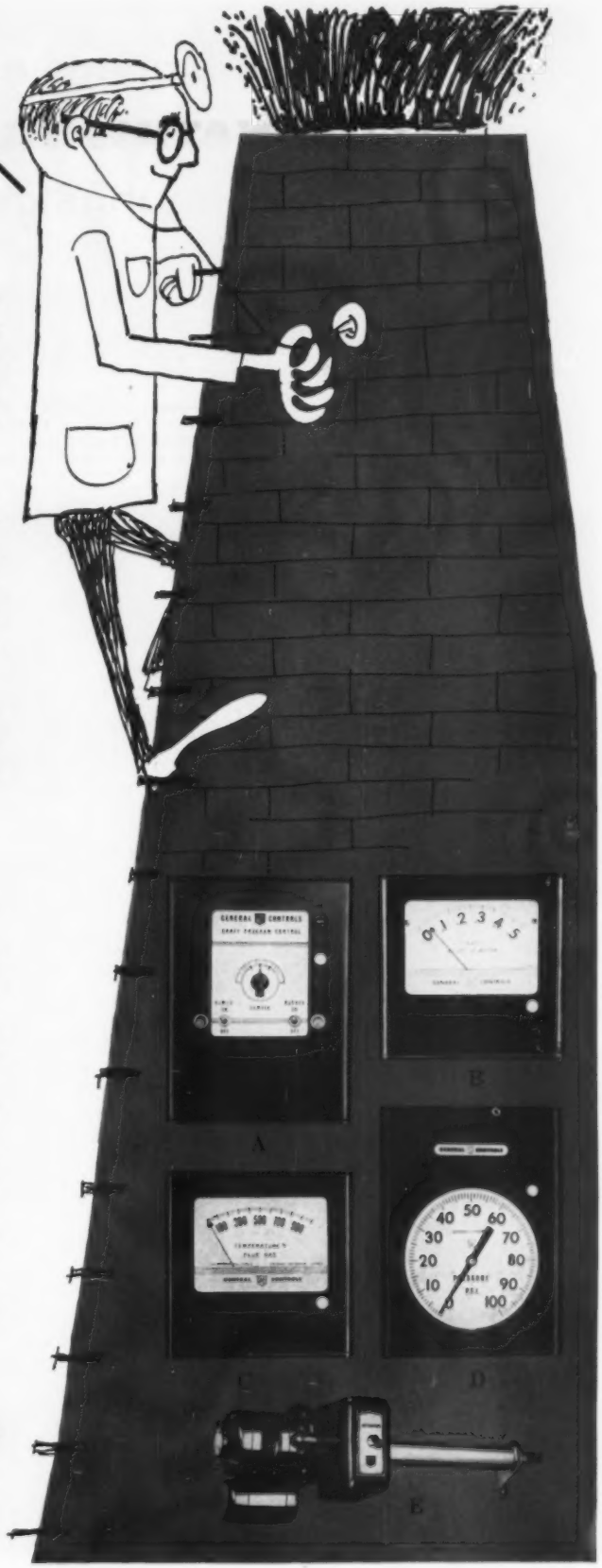
- **Capacity Protection**
- **Non-Overloading Power Feature**

To take advantage of this *exclusive* offering, call your nearest Sturtevant Division Sales Engineer, or write Westinghouse Electric Corporation, Department B-1, Hyde Park, Boston 36, Massachusetts.

J-80666



"My advice:
QUIT SMOKING!"



Smoking costs too much. It's a sure sign fuel is being wasted... that burner and boiler are losing efficiency... that profits are going up with the smoke. But you *can* do something about it! **Install a GENERAL CONTROLS DRAFT CONTROL SYSTEM.**

Goes in easily and inexpensively with any type boiler... any type fuel. Pays for itself over and over again through the years by cutting fuel waste... saves as much as 25% on fuel cost as well as saving on manpower. Not least, think of the plant and city-area good will you'll create with effective smoke control.

Call in the GENERAL CONTROLS MAN in your area to check out a draft control system for your plant now. The sooner, the better your long-range profit picture will look.

HOW TO IMPROVE YOUR BOILER EFFICIENCY:

A DRAFT PROGRAM CONTROL: start-up, shut-down, sets damper for any firing rate. Fast, accurate... senses atmospheric changes.

B DRAFT INDICATOR: provides continuous visual readings of draft conditions in combustion chamber and/or stack.

C FLUE GAS TEMPERATURE INDICATOR: shows boiler efficiency by indicating excessive heat loss.

D STEAM PRESSURE INDICATING CONTROLLER: indicates boiler pressure on main instrument panel, and gives accurate on-off, or proportioning control.

E ACTUATOR: operates stack damper to maintain constant combustion chamber draft.

A draft control system like this is worth money in the bank to you. Get the full facts today from

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General Contractor: George A. Fuller Company, New York, N. Y.
Structural & Mechanical Engineers: McGeorge Hargett & Associates
Consulting Mechanical Engineers: Jaros, Baum & Bolles
Heating & Air Conditioning Contractor: The Feldman Bros. Company, Cleveland, Ohio
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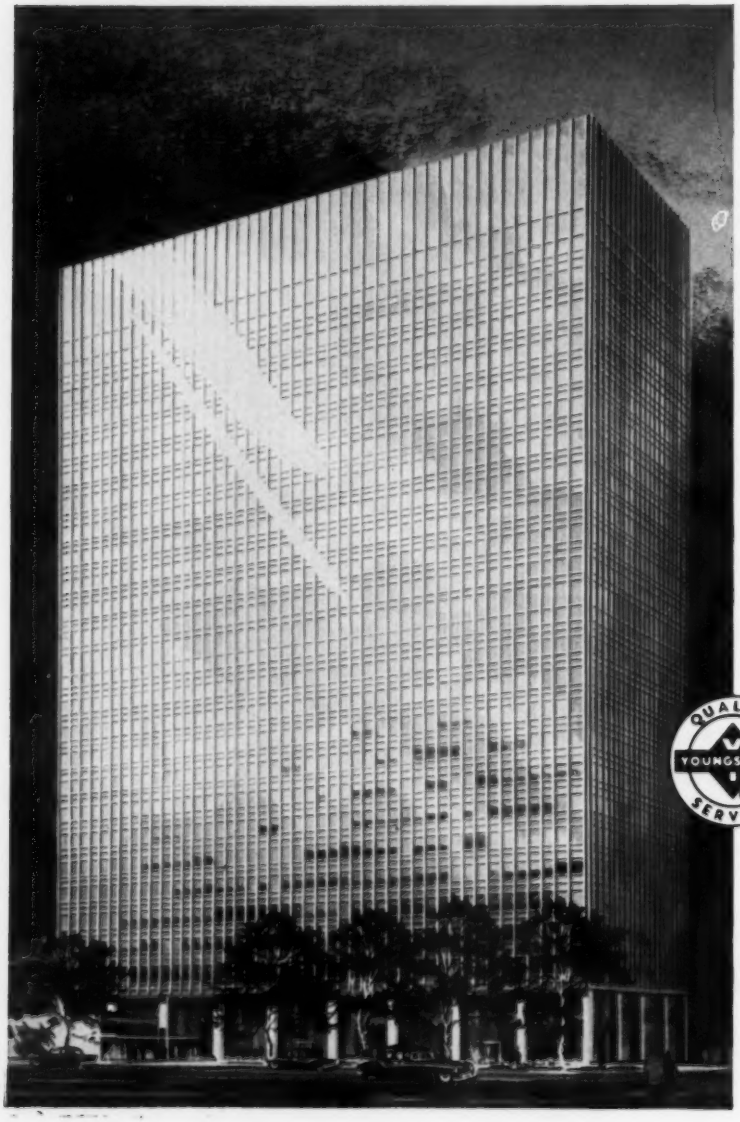


Cleveland's newest architectural beauty — this modernistic 22-story Illuminating Building — will provide much-needed air-conditioned office space for the "Best Location in the Nation". Owner of the new structure, 55 Public Square, Inc., and the architects, wisely chose Youngstown Steel Pipe to provide for a long-lived, dependable water supply system.

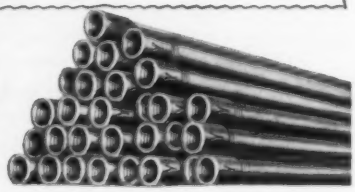
Youngstown Steel Pipe is the best pipe obtainable—anywhere. That's because it's made from our highest quality steel by men who have devoted their lives to the pipemaking business. Each and every step in Youngstown's completely integrated operations is closely quality-controlled by expert metallurgists to guarantee pipe that will meet your most exacting specifications.

Your nearby Youngstown Pipe Distributor has complete and ample stocks in all sizes. Why not call him today and discuss your requirements?

Specify Youngstown and secure these
7 Points of uniform goodness

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

QUALITY V YOUNGSTOWN SERVICE



THE YOUNGSTOWN SHEET AND TUBE COMPANY

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HUSKY WELDING FITTINGS

Welded installations are generally conceded to be superior in all respects, but the high cost of available fittings has curtailed their use to any great extent in low-pressure systems. *Husky* fittings now supply the answer. They are made especially for 150 lb. welded systems . . . and are priced to make installed cost the same or less than that of threaded installations.

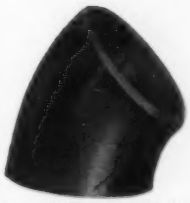
FOR 150 lb. INSTALLATIONS*

Husky Straight Tees—No. 211
2" through 6"

Husky Reducing Tees—No. 211R
2" x 2" x 3/4" through 6" x 6" x 5"

Husky 90° Elbows—No. 207
2" through 6"

Husky Reducers—No. 201
2" x 1-1/4" through 6" x 5"



Husky 45° Elbows—No. 206
2" through 6"

* Fabricated from A106B seamless carbon steel tubing with minimum wall thickness of Schedule 40 tube in comparable sizes.

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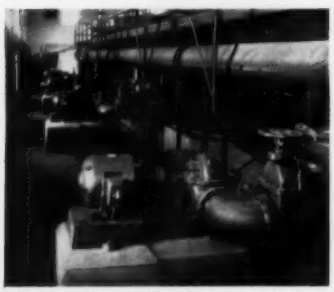
FREEDOM
from pumping worries

TAKES THE HEAT OFF This pair of 8" Type L-3 Weinman pumps supplies water to oil and hydrogen coolers for 30,000 k.w. turbo-generator at Columbus and Southern Ohio Electric Company.

No problems here with big capacity Weinman Type L Pumps on the job

It takes a pump with a lot of "work-ability" to give long-lasting, low-cost service on the big jobs shown here. These Weinman single-stage, split-case centrifugal pumps are built to outperform all others in heavy-duty, continuous operation. Available in 3 models for low, medium or high head service. Free Bulletin No. 1200SS gives complete information. Write for your copy today.



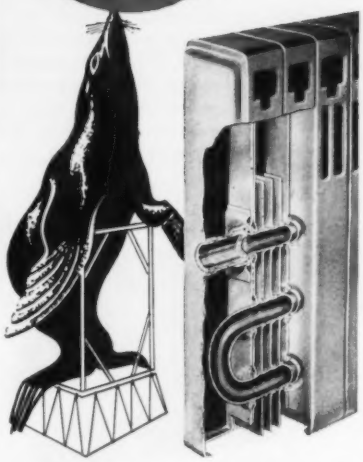
HOW TO MAKE A RAISE WITH FOUR OF A KIND 4 Weinman Type L-3 pumps boost filtered water from clear water chambers under beds to 50' elevated storage tank at municipal pumping station. Day-in, day-out service is no strain for these units . . . maintenance costs are negligible.

NO HOT AIR 3 Weinman Type L-1 pumps easily handle needs of this 4,902,196 cu. ft. air conditioning plant for large Federated Department Store. Efficient Weinman pumps deliver rated capacity at wear-saving motor speeds. Cost much less to own and operate.

THE **WEINMAN PUMP** MFG. CO.
290 SPRUCE ST. COLUMBUS 8, OHIO

Centrifugal Specialists

ONLY SHAW radiators deliver radiant and convected heat Properly Balanced ★



Shaw Panel Radiators distribute a carefully engineered combination of radiant and convected heat that only Nature, at her best, can rival.

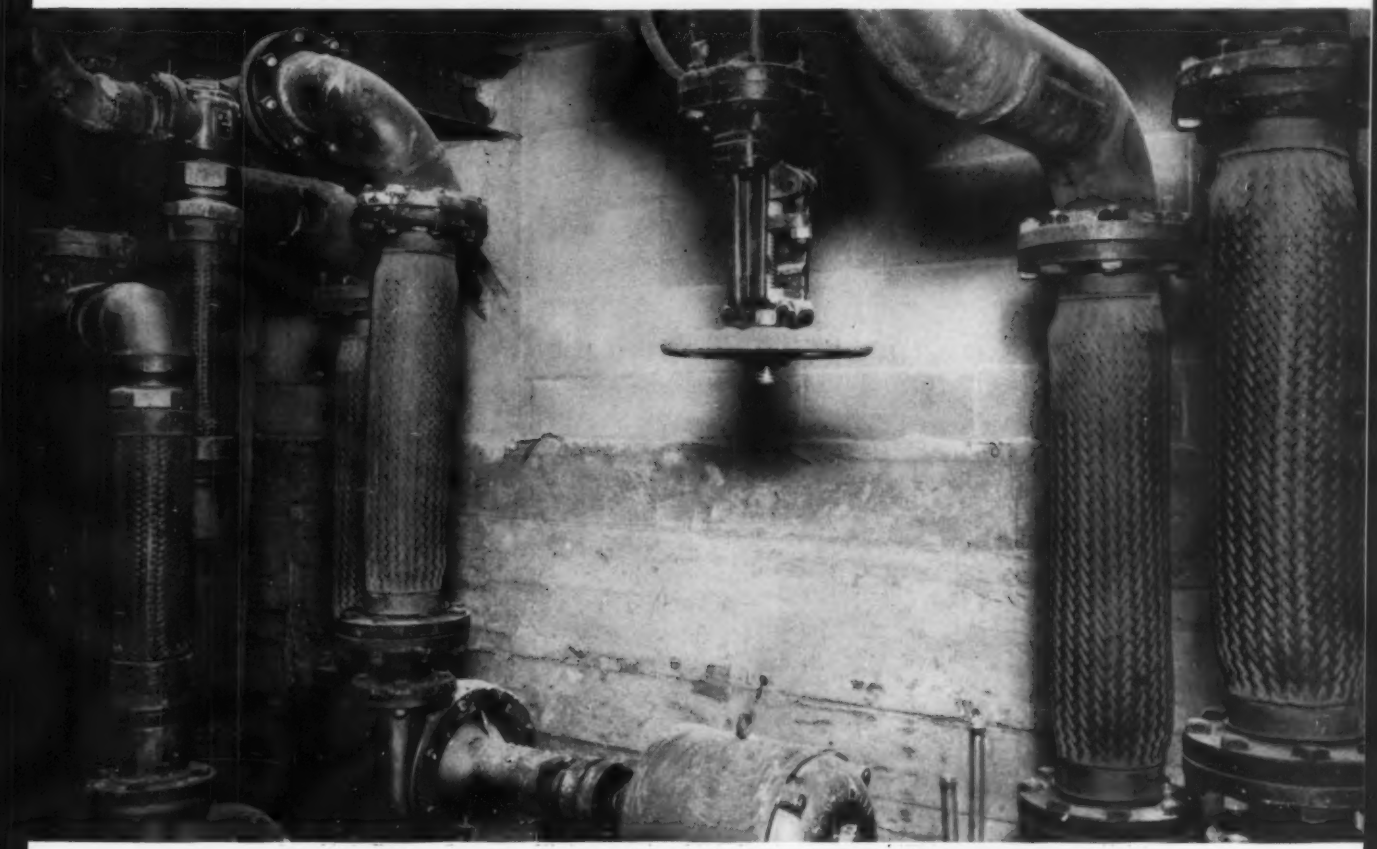
Shaw's health-guarding proportions of radiant and convected heat will not vary regardless of hot water or steam temperature. There is no stratification—heat is distributed evenly throughout the room.

Investigate Shaw Panel Radiators. They are rugged, self-contained steel and copper units, of one-piece-bonded construction, easy to handle and install. Heights are 8" to 26"; lengths 11" to 111". Choice of same end or opposite end tapping on all models facilitates piping economies and proper radiator location. Write today for full information.

SHAW-PERKINS
MANUFACTURING COMPANY
201 East Carson St. • Pittsburgh, Pa

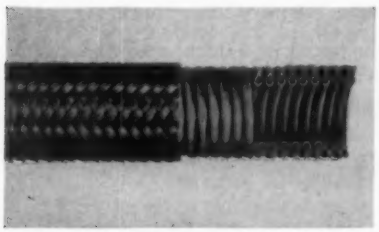
APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe®



Four 5-inch Flexpipe Connectors 30" long and four 3-inch Flexpipe Connectors 18" long connect pumps with hot water heating mains in big new Detroit Lakes, Minnesota, Senior High School. Architects: Traynor & Hermanson, St. Cloud, Minn. Engineers: Gausman & Moore Inc., St. Paul. Mechanical contractors: Holm Brothers, Atwater, Minn.

Flexpipe connectors handle expansion on long horizontal runs in big hot water job—eliminate vibration from pumps



FLEXPIPE'S flexible core can be either tin bronze, hot-dipped galvanized steel or stainless steel. End fittings (attached): flanges, threaded males and welding nipples.

The multi-structure design of many modern schools and institutions often makes necessary long horizontal runs for the heating mains. In hot water systems, it is very desirable, if not essential, to prevent transmission of vibration from the pumps to the mains. Flexpipe flexible connectors are designed for this service—will reduce pump vibration and noise.

Flexpipe connectors at the same time take up expansion and contraction in the mains. Thus in many cases they eliminate the need for expansion bends — make possible smaller, more economical tunnels—simplify and speed installation, reduce maintenance.

WHERE TO BUY: Flexpipe connectors come in convenient standard sizes, are sold by leading distributors. For the name and address of the one serving your area, or for more detailed information, write to: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario. 58227

Flexpipe® an ANACONDA® product

made by The American Metal Hose Division of The American Brass Company

Electrowheel *

another LAU "first in the industry"

Here's another Lau first, designed to help solve those cramped space blower installation problems. The versatile Lau "Electrowheel" is recommended for use whenever air moving efficiency is a requirement but space limitations present a problem. The "Electrowheel" is extremely efficient when operating where the utmost in compactness and smooth, quiet operation is required.

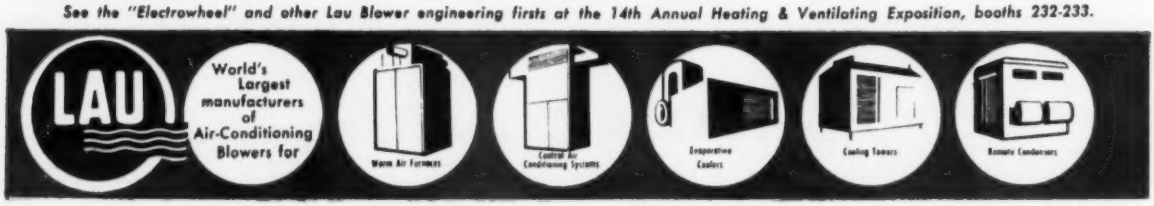
Lau "Electrowheel" features include stationary rubber mounted shaft, sealed ball bearings, rigid one piece motor mounts, 30" motor leads with BX connector and the same high standard of quality found in every Lau engineered product. One moving part assures years of trouble-free service.

When an installation requires a high performance blower the Lau "Electrowheel" is the logical answer. Write for Lau Catalog LSO-463 for complete information.

*So named because a high quality external-rotor motor forms the wheel hub . . gives you more air delivery in a small package than ever before possible!

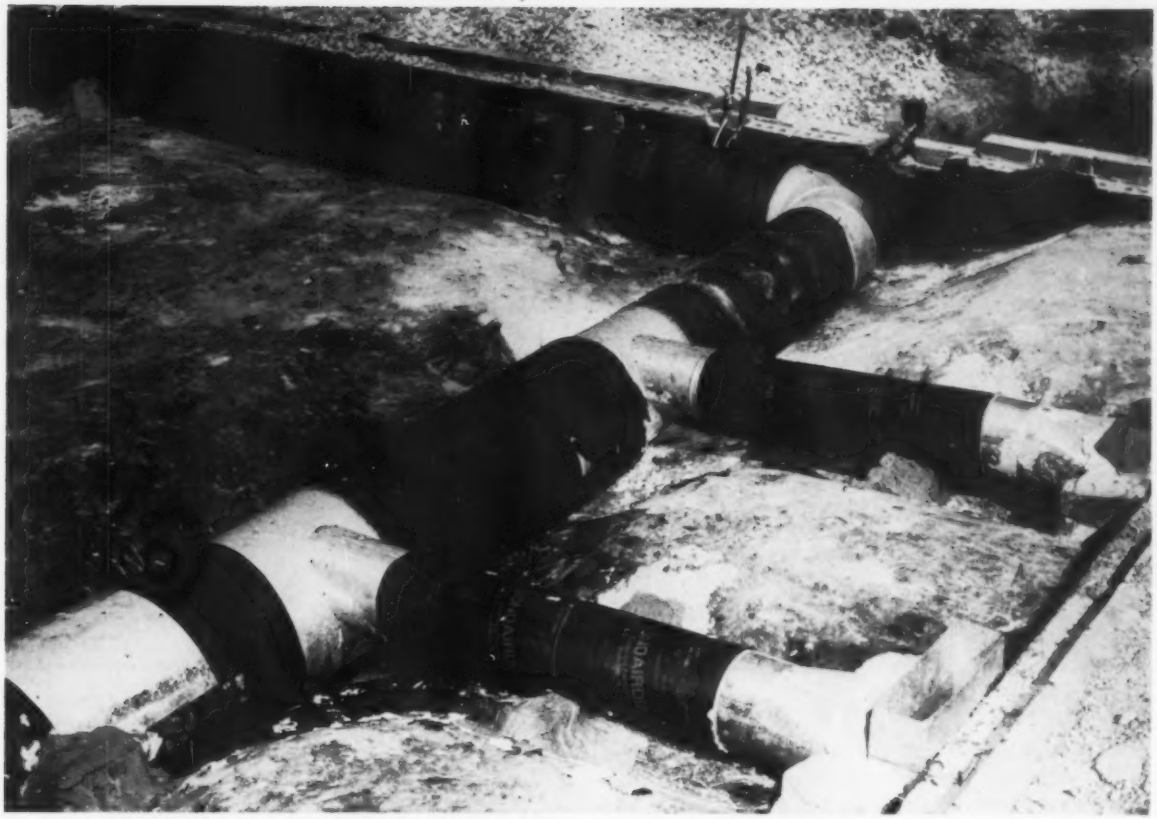
THE LAU BLOWER COMPANY, 2027 Home Avenue, Dayton 7, Ohio

See the "Electrowheel" and other Lau Blower engineering firsts at the 14th Annual Heating & Ventilating Exposition, booths 232-233.



Bid Lower and Make More

ON SCHOOL JOBS...



SONOCO Sonoairduct enables you to save installation time, labor and money—without lowering the quality of construction! It is easy to handle and level. Available in 23-sizes—2" to 36" I.D., with the larger diameters ideal for schools, shopping centers, churches and industrial heating and ventilating. Widely used and approved by contractors. Meets and exceeds F.H.A. criteria and test requirements for products in this category.

Made in specified lengths up to 50' long, and can be sawed to exact lengths on the job. Aluminum foil lined. Free installation manual available. See our catalog in Sweet's.

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for warm air gas and oil fired slab perimeter heating systems!

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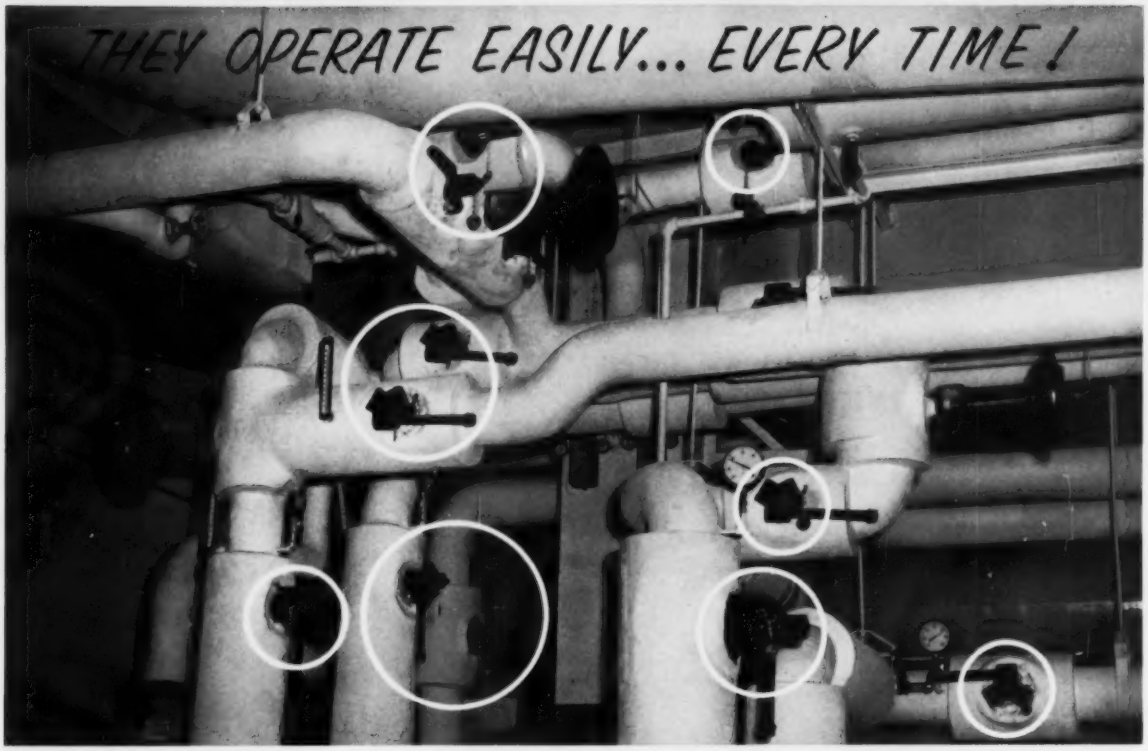
Construction Products

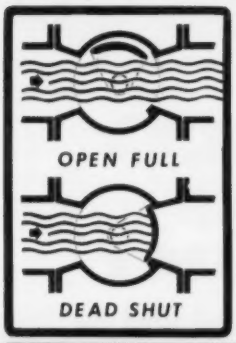
SONOCO PRODUCTS COMPANY

DeZURIK...*the BEST valve for air conditioning because...*



ECCENTRIC ACTION

The easy operation of DeZurik Valves is the result of their *exclusive* Eccentric Action. The plug is pivoted eccentrically in the valve to match the eccentrically-raised body seat. The plug touches the valve body ONLY when the valve is closed. There's no need for lubricants because there's no friction. . . .only easy operation every time! The first fractional movement in opening the valve backs the plug away from the seat and it swings wide open easily, without binding, without scoring!



ONLY DeZURIK VALVES GIVE YOU ALL THESE ADVANTAGES:

1. Easy Operation
2. Drip Tight Shut-off
3. Low Pressure Drop
4. Best for Balancing
5. Low Installation Cost
6. No Maintenance
7. Proved Record of Dependability
8. Compact Size
9. Economically Priced
10. Versatility beyond compare

EASY OPERATION ASSURED

DeZurik Valves provide easy operation on chilled water, condenser water, pump shut-off, balancing service — on every air conditioning application!

These DeZurik Valves are installed on chilled and condenser water service in the Esso Standard Oil Office Building (Towson, Md., James Posey, Consultant). Note the short levers with which these valves are operated. . . .further indication that DeZurik Valves are the easiest operating valves you've ever tried!

Available in sizes from 1/2" thru 20". For more details, see the DeZurik representative in your area, or write to

DeZURIK CORPORATION
SARTELL, MINNESOTA

COPPER

simplifies plumbing in big addition to Children's Hospital, Pittsburgh

ARCHITECT'S RENDERING of Children's Hospital Addition (foreground) at Pittsburgh. *Architect*: Alfred D. Reid Associates, Pittsburgh. *Consulting Engineer*: J. A. Murray, Pittsburgh. *Plumbing Contractor*: Sauer, Inc., Pittsburgh.

MAKING A SOLDER JOINT on an 8-inch copper soil and waste line – the largest size used in the drainage system. Solder-joint connections are one of the important reasons why copper tube systems are so much easier and faster to install.

TESTING A VALVE on the hot-water supply system. Other copper tube lines in view are part of the sanitary drainage system, ranging in size from 1½ inches to 4 inches. Because connections are easily made, even in tight quarters, the lines can hug the ceiling.

SOME 70,000 pounds of Anaconda copper tube were used in the sanitary drainage system, hot- and cold-water lines, oxygen, vacuum, and compressed-air lines of the addition to Children's Hospital in Pittsburgh.

Copper plumbing provides the advantages of easier, faster installation, with additional economies in design and construction made possible by the lighter weight of copper tubes and the trim, space-saving, solder-joint fittings. Equally important, however, are the long-range benefits. Copper tube systems last longer, require less maintenance than systems of other materials.

Everyone benefits with all-copper plumbing. Architects have greater freedom in design to locate bathrooms and utilities where desired without sacrificing useful space. Contractors report that installation time has been reduced up to one-half – and their men prefer working with copper tube. Owners get plumbing that lasts – costs little to maintain.

Anaconda Copper Tubes are available in all standard wall thicknesses – Types K, L, M, and DWV (Copper Drainage Tube) – through plumbing wholesalers. There's a full line of Anaconda wrought and cast solder-joint fittings. For more information on ALL-COPPER plumbing, write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

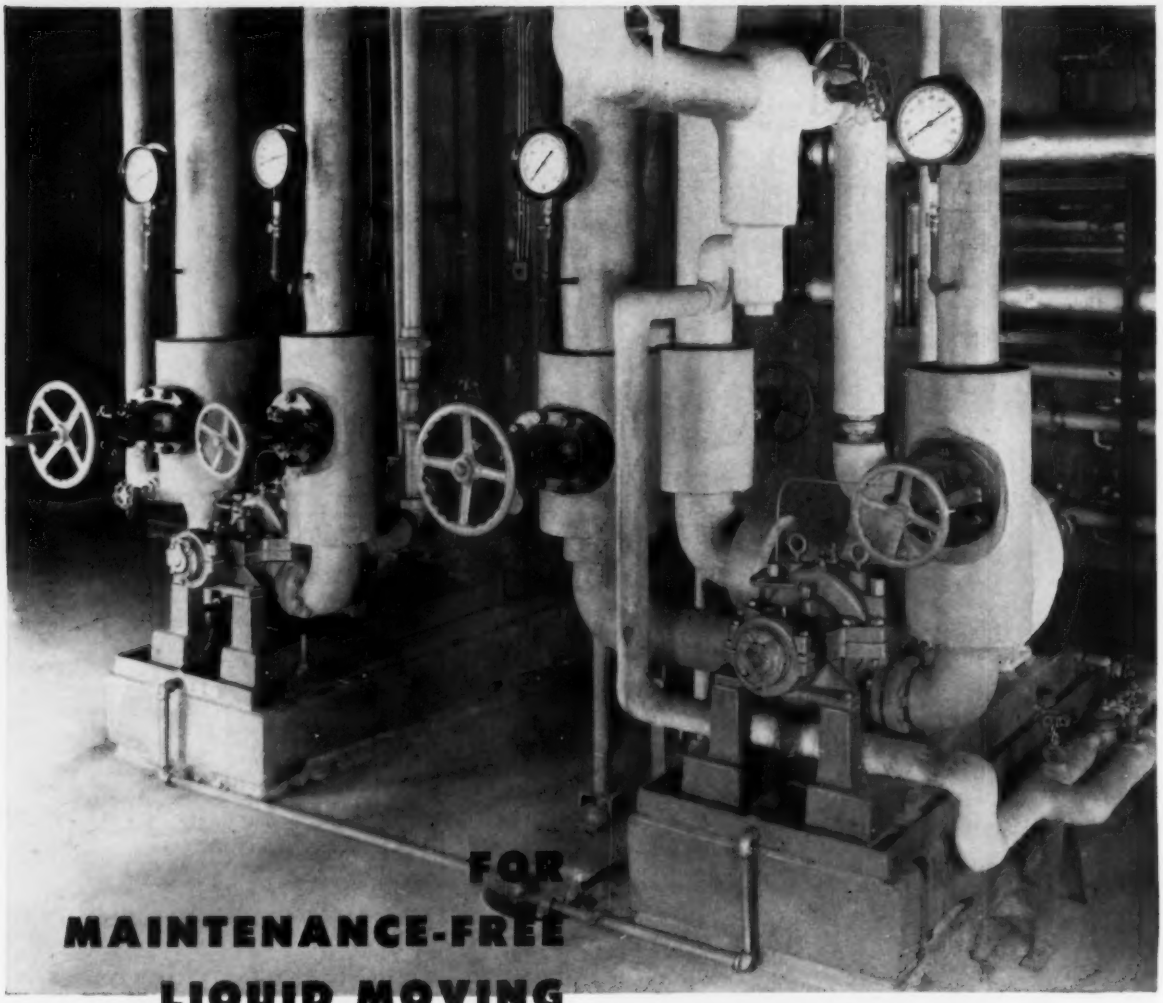
LM59

ANACONDA®

COPPER TUBES AND FITTINGS

Products of **THE AMERICAN BRASS COMPANY**

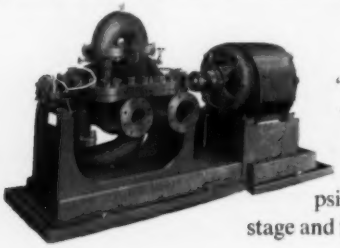
Available through Plumbing Wholesalers



FOR MAINTENANCE-FREE LIQUID MOVING

"Buffalo" Class "RR" Pumps

For boiler feed and other high pressure, high temperature applications with clear water, "RR" Pumps deliver the utmost performance with an absolute minimum of maintenance. The unique "Buffalo" Class "RR" design is unsurpassed for consistent hydraulic balance. Rugged "Buffalo" construction features include efficient impellers — extra generous bearings and shafts — rigid casings with simply-formed passages to avoid friction losses — very deep stuffing boxes to accommodate more packing.



"Buffalo" Type "RR" Boiler Feed Pumps for pressures up to 500 psi. Available in two-stage and four-stage models.

These superior "Buffalo" design and construction features assure you of pumps that will stand up under continuous punishing service — that require practically no attention other than lubrication — that deliver more water at less cost for power.

The "Buffalo" Class "RR" Pump is your best buy for clear water service — hot or cold — against heads as high as 1500 feet — at capacities up to 900 gpm. Ask your nearby "Buffalo" engineering representative for full information, or write us for Bulletin 980-D.

"Buffalo" Pumps bring you the famous "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.

BUFFALO PUMPS

"Buffalo" PUMPS

Division of Buffalo Forge Co.

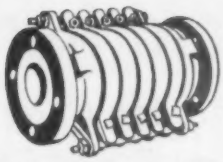
171 Mortimer St. • Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.

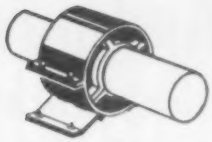
Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

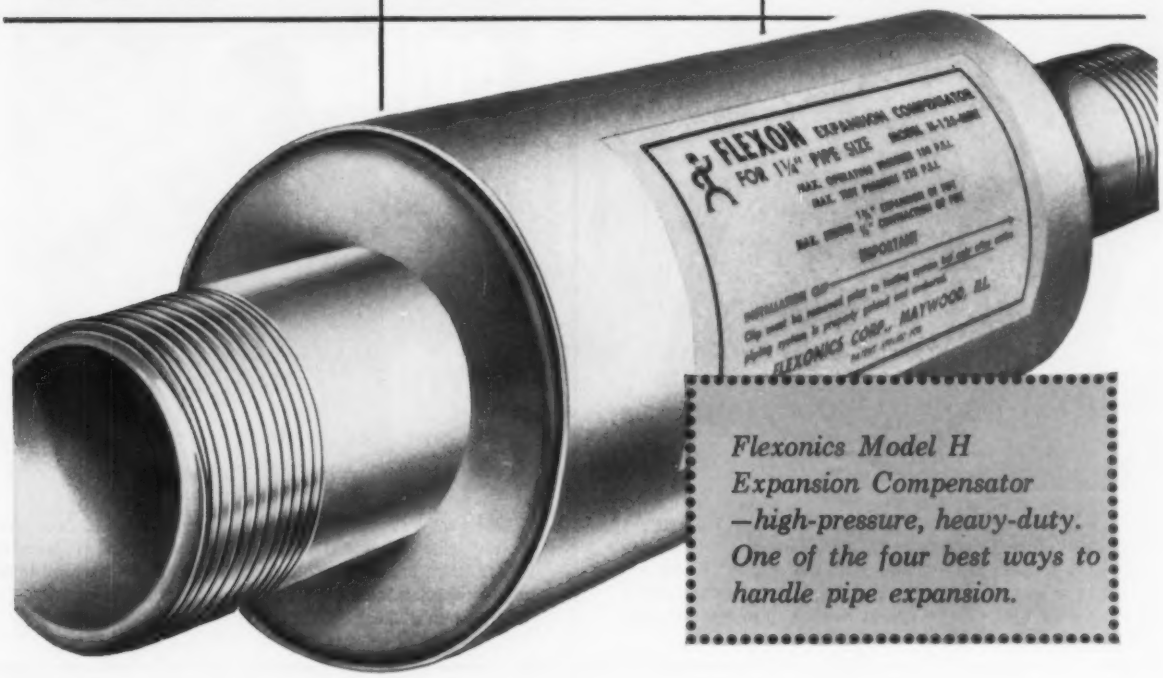
Flexonics Model L Expansion Compensator — to handle pipe and tubing motion up to ½" in low-pressure heating systems.



Flexonics Expansion Joints — controlled-flexing, free-flexing, and many special types, in an unlimited range of sizes.



Flexonics Pipe Guides — a completely new and better way to keep pipe in alignment. Positive, rugged, inexpensive.



Flexonics Model H Expansion Compensator —high-pressure, heavy-duty. One of the four best ways to handle pipe expansion.

INCH FOR INCH, THE LOWEST-COST WAY TO TAKE UP PIPE EXPANSION

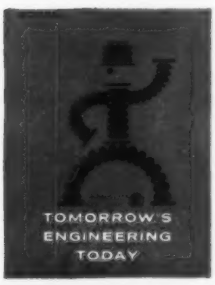
Any way you look at it, the Flexonics Model H Expansion Compensator *costs less* — costs less per inch of stroke than any other way to handle pipe motion — costs less after it's installed because it never needs maintenance.

Yet the Model H is built for hard service. Its 2-ply stainless steel Flexonics bellows is designed to outlast the building. Steel-encased and heliarc welded for full protection from external damage. Positive internal guide and anti-torque device. Completely packless. No servicing necessary after installation.

These are the reasons why engineers and piping contractors are specifying the Flexonics Model H for thousands of industrial piping jobs that use pipe up to 3" and require up to 2" total movement at each Expansion Compensator. Working pressures to 175 p.s.i. for ¾" and 1" sizes; to 125 p.s.i. for larger sizes up to 3".

Make the Flexonics Model H Expansion Compensator a cost-cutting part of your next piping job.

Today—write for informative and helpful Catalog No. 163R.



Flexonics
EXPANSION COMPENSATORS

FLEXONICS CORPORATION • 1391 SOUTH THIRD AVENUE • MAYWOOD, ILLINOIS

Divisions
INDUSTRIAL HOSE • EXPANSION JOINT • BELLOWS • AERONAUTICAL • AUTOMOTIVE
Flexonics Research Laboratories, Elgin, Illinois
In Canada: Flexonics Corporation of Canada, Limited, Brampton, Ontario

"And now, a word from my sponsor"

says Garry Moore, star of the Garry Moore Television Show, seen Tuesdays at 10 p.m. E.S.T., CBS-TV Network

"I'm Garry Moore, and this is PPG's Glasfloss Fiber Glass Safety-Grille Filter. I want to tell all you gentlemen . . . and any ladies who happen to be listening . . . a couple of very important reasons why the Glasfloss Safety-Grille Filter offers you the most for your money in any heating or air conditioning installation."

"See this? The old metal grille has been eliminated. The Safety-Grille chipboard won't nick hands or cut fingers because there are no sharp edges. This is an important safety angle for maintenance men who must handle hundreds of filters when making a filter bank change."

"This should happen to a filter? Just in case you ever bent a Glasfloss Filter like this, you'd find it would snap back in shape. That's because of its one-piece chipboard construction. No metal grille to get bent out of shape. There's less chance of filter damage in transit, storage and handling."

"Efficient? You bet! But don't take my word for it. Try Glasfloss Fiber Glass Safety-Grille Filters yourself and see how well they perform in actual service. Your local Glasfloss Distributor or PPG Warehouse carry the complete range of sizes. Call them for service, and tell them Garry sent you."

Glasfloss® Safety-Grille* Filters are a product of the Fiber Glass Division of Pittsburgh Plate Glass Company

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

*Trademark

FIBER PPG GLASS PITTSBURGH PLATE GLASS COMPANY

Only Halstead & Mitchell offers a cooling tower with a 20-YEAR GUARANTEE

ON THE WETTED DECK
AGAINST FAILURE
DUE TO ROTTING
OR FUNGUS ATTACK

Here's why this is important: Fungus growth on cooling tower wood fill very often can accumulate to the extent that it actually obstructs air flow through the tower. This reduces tower capacity and affects performance of the refrigeration or air conditioning equipment involved. In severe cases, the wood will rot and cause tower failure.

Treated Deckings—For positive protection against such harmful effects, Halstead & Mitchell subjects the wood deck material used in all H&M cooling towers to a special, pressure creosote treatment. That's why *only* Halstead & Mitchell offers a 20-Year Guarantee on the wetted deck against failure due to rotting or attack by fungus. Original tower capacity is maintained, and that reliability is what cooling tower purchasers need.

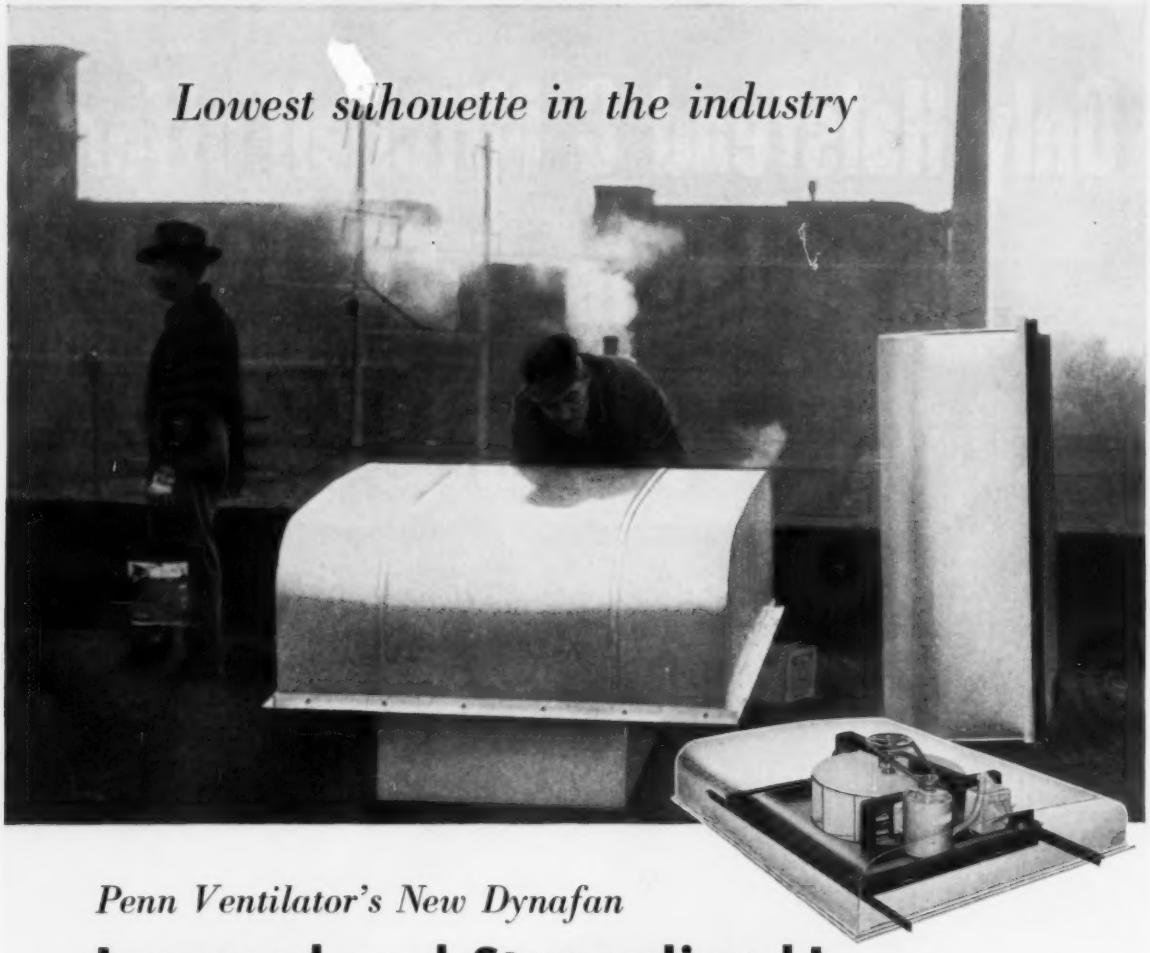
Anti-Corrosion, Plastic Coatings—Halstead & Mitchell Cooling Towers have many other design features that increase tower life and keep maintenance costs to a minimum. For instance, the cooling tower casings are completely protected against corrosion by separate plastic coatings of Vinsynite, Vinyl Zinc Chromate, and chlorinated rubber, *after assembly*. Every edge, every corner, is sealed against rust.

Permanently Sealed Bearings—Another example, fan bearings are permanently lubricated and sealed. Damaging moisture is kept out. Maintenance and periodic greasing are eliminated.

H&M Cooling Towers are available in capacities of 2 thru 125 tons. Types include propeller fan, centrifugal fan and take-apart models. See your local wholesaler, or write for more information. Halstead & Mitchell, Bessemer Building, Pittsburgh 22, Pa.

HM
Halstead & Mitchell

COOLING TOWERS · WATER-COOLED CONDENSERS
AIR-COOLED CONDENSERS · FINNED COILS



Penn Ventilator's New Dynafan

Lowered and Streamlined!

Low-Contour Dynafan. That's the name we've given to our new roof exhauster. It cuts almost 50% off normal roof exhauster heights . . . and its lines are cleaner, more modern. The Low-Contour Dynafan is the safest insurance that clean lines designed into modern buildings will not be compromised. And for more uniform appearance, the same modern housing is available for use as supply and relief units.

The new Low-Contour Dynafan is more than just low and clean-lined. Major engineering advances are incorporated . . . for example, you won't find the motor atop the wheel as with other roof exhausters, and you won't find the vibration-prone overhung shaft, either. Instead, noise has been cut appreciably by straddling . . . now the fan wheels are supported between sealed ball bearings located above and below the wheels. And the entire fan unit floats on vibra-sorb vibration eliminators. In addition, exact type motors to fit your particular service condition are supplied.

Get all the details on Penn Ventilator's new Low-Contour Dynafan. Call your local Penn Ventilator representative, or write to Penn Ventilator Co., Philadelphia 40, Pa.

PENN VENTILATOR CO., INC.
GOODMAN & ALLEGHENY, Philadelphia 40, Pa.
Representatives and Distributors in Principal Cities
Charter member of AMCA

Free from NIBCO

send today!

This free catalog for 1959 illustrates and gives complete specifications of NIBCO low pressure, pressure rated and special type bronze valves . . . including the sensational new Y-Pattern Globe and Check Valves. These are the valves that give you more shut-offs per dollar . . . fully guaranteed to operate perfectly. See your wholesaler or send coupon below.

VALVE CATALOG VC-3

NIBCO, INC. — Dept. J-6402, Elkhart, Indiana
Please rush free copy of your new Valve Catalog No. VC-3.

Name_____

Firm_____

Address_____

City, State_____

☐ Also send address of nearest source of supply.

Architect: Kenneth Franzheim and Associates, Houston

General Contractor: W. S. Bellows Construction Corporation, Houston

Engineer: Dale S. Cooper and Associates, Houston

Heating and Air Conditioning: Barber, Inc., Houston

Heating and Air Conditioning with

USS National Pipe—

Houston Office
The Prudential Insurance Company of America

A prominent fixture on the Houston sky line is the massive 21-story Houston Office of The Prudential Insurance Company of America. Within this modern structure, Prudential employees enjoy the year-round comfort of a heating and air-conditioning system served by 120 tons of USS National Seamless Pipe in sizes 4" O.D. through 16" O.D.

This is the second of Prudential's efficient new office buildings to rely on National Pipe. The 41-story Prudential building in Chicago used about 200 tons of National Pipe in its air-conditioning, heating and plumbing systems.

Do you need quality pipe for air-conditioning, heating and power installations? Seamless or butt-welded pipe that will pay you back in outstanding service a hundred times over for every dollar you spend for it? Then be sure to say "NATIONAL PIPE." If you'd like further information or immediate assistance with your pipe problems, write to National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS and NATIONAL are registered trademarks

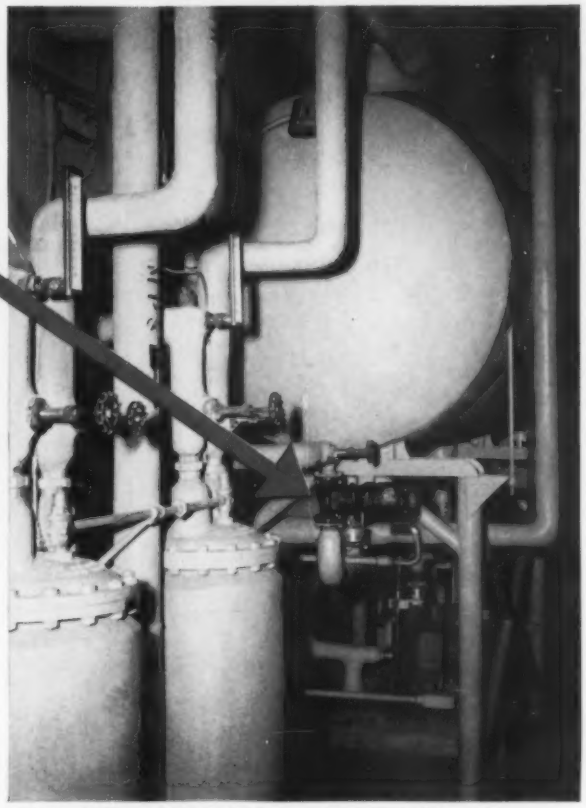
"The world's largest and most experienced manufacturer of tubular products"

National Tube Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • United States Steel Export Company, New York

B&G ALL-BRONZE BOOSTERS

FOR LONG LIFE IN CIRCULATING HOT OR COLD RAW SERVICE WATER FOR FAUCET OR INDUSTRIAL USES

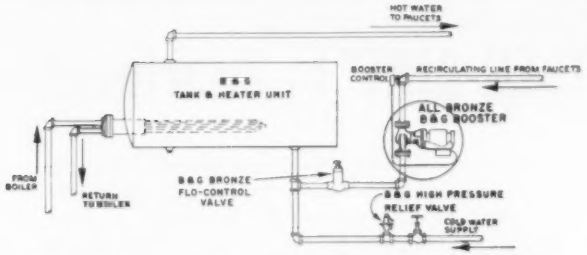


Where hot or cold service water is to be pumped, the use of an all-bronze pump is imperative. Otherwise, the corrosive effects of continuously pumping fresh water materially shortens pump life.

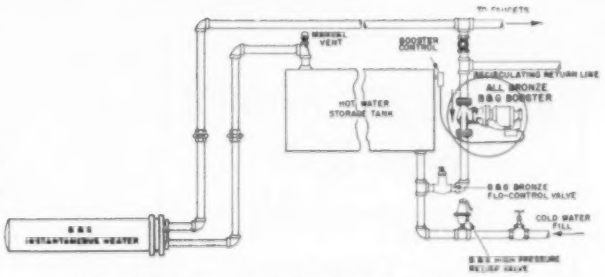
The B&G All-Bronze Booster is specifically built for service water pumping applications. In such systems, the Booster can be installed in numerous ways to step-up efficiency, increase hot water production and reduce heating costs. It is immune to corrosion, hence will give years of dependable service.

For *quiet* operation, failure-proof performance and long life, the B&G Booster is the *preferred* pump.

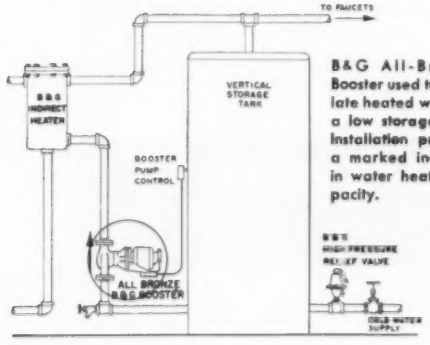
Installation of B&G All-Bronze Booster in Chrysler automatic transmission plant at Kokomo, Indiana. This small unit handles the circulating requirements of the service water heating system.



B&G All-Bronze Booster used on recirculating line from hot water faucets maintains hot water at fixtures at all times. Recommended on all installations, particularly where long plumbing lines are used.



All-Bronze B&G Booster used to provide an extra supply of hot water from an undersized boiler. Semi-tankless hook-up maintains initial supply of hot water.

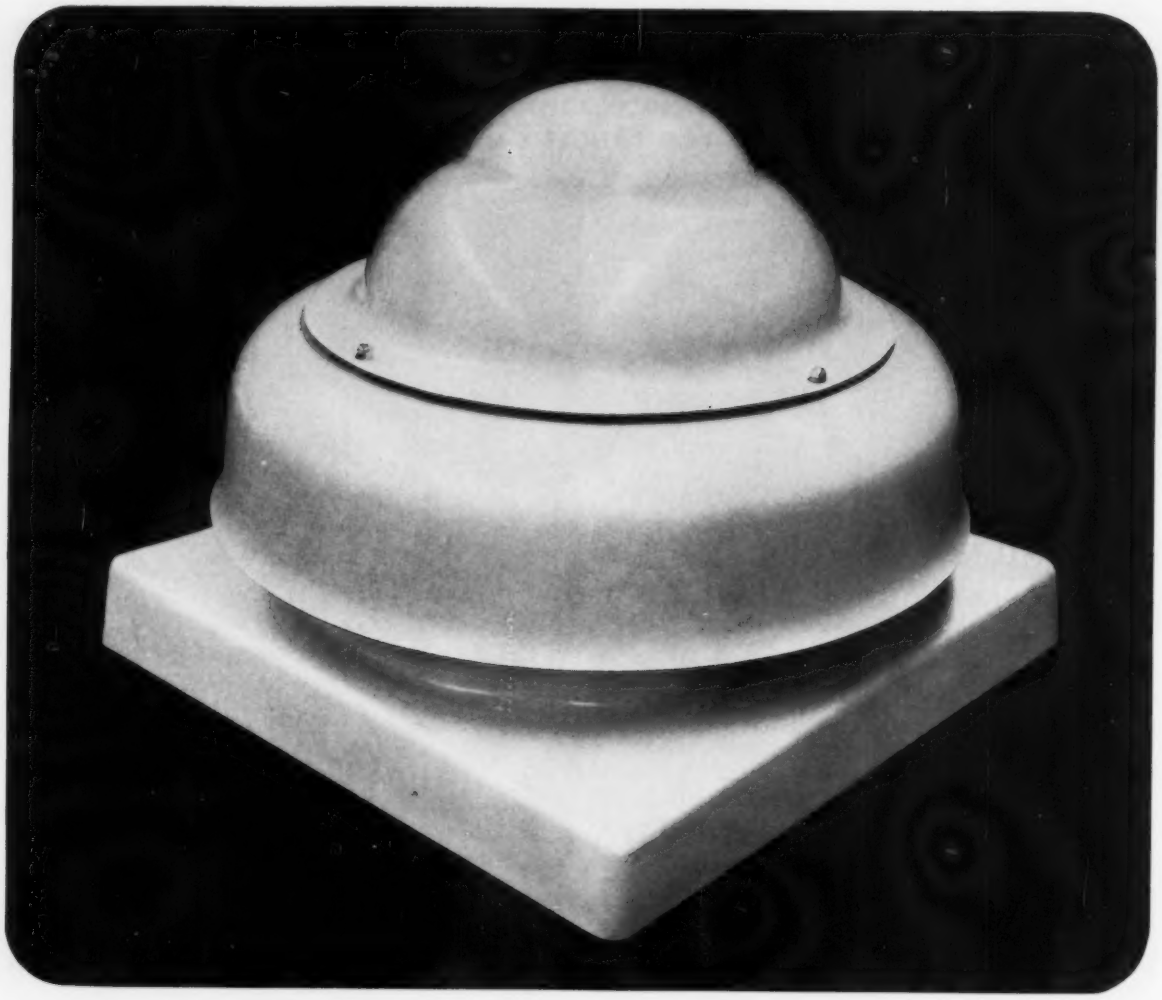


B&G All-Bronze Booster used to circulate heated water to a low storage tank. Installation provides a marked increase in water heater capacity.

Send for Bulletin No. IA-856

BELL & GOSSETT
COMPANY
Dept. FP-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario



Introducing the all new "FIBER-AIRE" by Swartwout

All Fiberglas* Housing
Super Quiet
Indestructible
High Efficiency

- Fiber-Aire's all Fiberglas* housing actually **absorbs** noise and vibration . . . sets a new standard for ventilator quietness.
- Bonded Fiberglas* housing is virtually impossible to dent, crack or break . . . unaffected by salt spray, weather, fumes and most chemicals.
- Low contour and molded-in sky blue color enhance building design . . . Fiber-Aire never needs painting.
- Stainless steel air flow guides eliminate internal air shocks . . . increase efficiency . . . cut vibration.
- High efficiency throat and outlet minimize loss from friction and turbulence.

Fiber-Aire units are now available for immediate delivery in 21 direct and belt drive models with capacities from 180 to 4,000 CFM.

You'll get the complete story on the fabulous new Fiber-Aire ventilators in Swartwout's free bulletin "FA-1". Write now.

The Swartwout Co.
Ventilation Engineering
18568 Euclid Avenue Cleveland 12, Ohio

* TM Owens Corning Fiberglas Corporation

In Canada: Eastern Steel Products Ltd., 8 Bermondsey Road, Toronto, Ontario

HOW DUNHAM-BUSH PROVIDES POLAR PLEASURE FOR PENGUINS

Architect—Charles Faust
Consulting Engineer—George C. Ray
Contractor—Callahan Brothers
— Bossert Sheet Metal
Wholesaler — Refrigeration
Supply Distributor

Penguin Pavilion at San Diego Zoo. The pool is 55 feet long and 6 feet wide with depth varying from two feet to five feet. Here visitors may view the colony of penguins swimming or watch them in natural surroundings on the upper level.

A Heat-X 'PC' was selected because of its patented Inner-Fin construction, which greatly increases heat transfer efficiency and conserves vital space.

. . . IN SAN DIEGO

Penguins commonly observe formality... but that's not why lovely Dee Ann Fleming, Miss San Diego, is getting the cold shoulder here.

She's toe-testing water in the modern new penguin pool at the San Diego Zoo . . . water which efficient Dunham-Bush equipment maintains at the relatively polar-like temperature level of 50-60 degrees.

Not unexpectedly, the major demand here was for a balanced, livable environment—by penguin, not human, standards. And Dunham-Bush units—specifically a Heat-X 'PC' Package Chiller and two BC 1000 Remote Air Cooled Condensers—created climatic conditions which exactly duplicate those the penguin enjoys in his habitat.

To keep the birds comfortable while paddling in the pool or padding along poolside, a 30,000 gallon storage tank was installed; and the large concrete exhibition pool with surrounding promenade deck was set inside the tank. Both pool and deck are cooled by constant, direct contact with the tank's Heat-X 'PC' chilled water.

This installation is another convincing demonstration that Dunham-Bush repeatedly is called upon when the need is for product adaptability and reliable performance. Check with Dunham-Bush before your next air conditioning, refrigeration, or heating job.

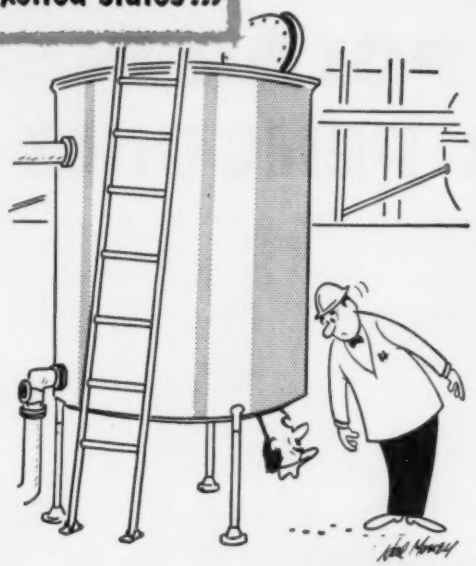
Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

AIR CONDITIONING • REFRIGERATION • HEATING • HEAT TRANSFER

Life in these excited states...



"I think I've found the leak, chief!"

A safer way to stick your neck out

Good equipment costs so *little* more, it pays to stick your neck out and ask for it. If the boss is cost conscious you'll *get* it. He too knows the dollars lost by corrosion and contamination. You're always safe when you specify Ace piping, valves, pumps and tanks.

Ace chemical-resistant rubber-lined steel pipe best for high-pressure, big sizes, or abrasives. Pipe, fittings and valves 1½ to 24".

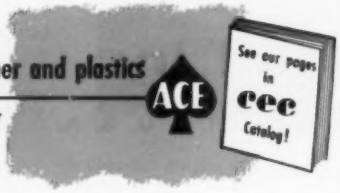
Highly efficient *WE* pump. Capacity to 360 gpm. Cast iron, fully protected by top quality, chemical resistant hard rubber lining.

Design assistance and facilities for molding special fittings, pump parts, etc., of plastics or hard rubber. Also large hand-fabricating facilities.

Variety and quality to match *any* plastic piping. Riviclor PVC, Ace-Ite rubber-plastic, Parian poly, Ace Saran, Tempron high temperature nitrile, hard rubber-lined steel.

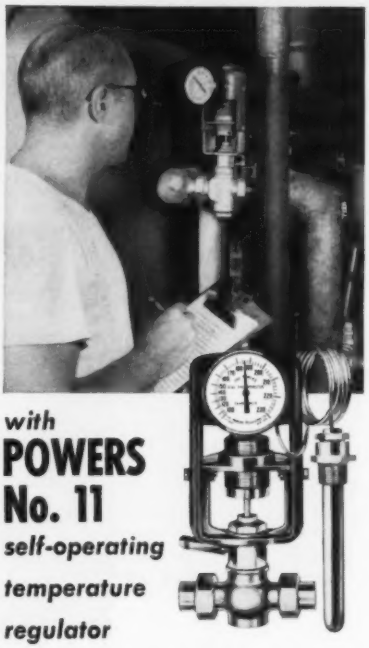
ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey



VISIBLE PROOF

of constant temperature control



with
POWERS No. 11
self-operating temperature regulator

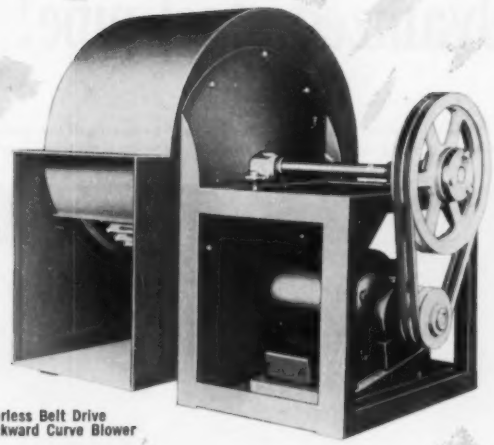
This big four-inch dial gives a quick, visual means of checking controlled temperatures . . . an accurate guide for regulator adjustment.

Designed for precise temperature control, the Powers No. 11 Regulator is self-powered . . . simple, compact and dependable. Full throttling action is gained without the aid of *any* external power source. Special valve stem lubricator eliminates binding. Big double ply metal bellows provide extra valve power — longer life. Union body assures easy installation.

For specifications, valve sizes, types and temperature ranges, call your Powers branch office—engineering services in 66 cities. Write for Bulletins Nos. 329 and 330.

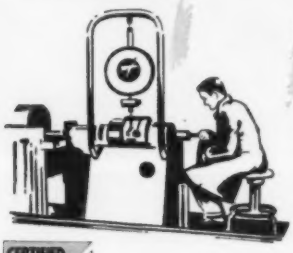
THE POWERS REGULATOR CO.,
Dept. 259, Skokie 6, Ill.

POWERS
TEMPERATURE CONTROL



Peerless Belt Drive
Backward Curve Blower

Peerless Belt Drive
Centrifugal Roof Ventilator



TESTED... AND RATED TO AMCA* SPECIFICATIONS

*The new Air Moving and Conditioning Association formed by merging PFMA, NAFM and IUHA.

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• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Series on Industrial Ventilation Is Valuable Contribution to Design

THE ENDORSEMENT John H. Clarke gives to central station systems for industrial ventilation is a valuable contribution to the art of designing the trouble-free, low maintenance installations which management so urgently seeks.

With typical thoroughness, his article *Industrial Ventilation: How to Design for Heat Recovery* (November 1958) includes additional data on makeup air systems in the form of an installation cost comparison for a single 150,000 cfm system *vs* ten 15,000 cfm systems. Much time, effort, and investigation went into this cost study.

His recommendations are felt to apply equally well to several fields, namely: winter air makeup, with or without summer ventilation cooling; heavy duty heat relief with evaporation cooling; and air conditioning with refrigeration and psychrometric controls.

Central systems can keep operating people happier because:

1) Larger systems are better engineered, must have more thorough field studies and cannot be constructed without good detailed installation drawings. This all adds up to a better job and more successful performance.

2) Fewer repair jobs occur since service attention is more efficient and thorough.

3) Equipment components are of larger size and heavier construction, affording sometimes 25 to 50 percent longer life. This category involves 75,000 to 150,000 cfm systems. Big ventilating fans rarely wear out.

4) Savings in repairs in the 5 to 15 year age bracket will more than pay off the somewhat higher first costs.

The central system approach with thorough application studies often results in more accessible equipment locations. If roof truss location is chosen, then stairway and adequate working platform space are provided. The same holds true for a penthouse location. Unitary equipment rarely gets favorable accessibility.

One large metal producer permits central stations to be located on main manufacturing floors and in ground floor lean-tos. The payoff comes in when one considers that some 13 older central stations for makeup air supply ranging from 4 to 14 years old and located in plants in five states have only encountered repairs to three steam coils due to freezeup and practically no major repairs to fans, motors, and apparatus casing. There have been no replacements. This has meant steady operation, little downtime, and favorable acceptance by management. It is much easier to keep in condition one set of temperature controls, steam traps, condensate pumps, and perhaps evaporative cooling and to receive better attention from foremen and supervisors than with the equivalent five or 10 packaged units.

Evidence of low installation costs for central station air makeup systems is indicated by a 120,000 cfm unit installed in southern Ohio with a 240 ft run of overhead aluminum distribution ductwork. In 1947 the complete cost was 22c per cfm of air complete with all items as listed by Mr. Clarke in his November cost analysis. If installed today, some feel the cost would be doubled. However, a brick lean-to, 23 × 23 ft, was constructed adjoining the manufacturing area and admittedly its cost was not included since it was in the original plant construction.

Mr. Clarke's claims in favor of central station systems as well as counter claims by unitary proponents are admittedly controversial. But no harm to unitary equipment manufacturers need necessarily result. Some such manufacturers continue to conform to industrial standards for sheet gages, framing, bearings, etc. Many of these manufacturers also furnish complete engineering data and field application guidance. But sad to relate, it seems that some unitary jobs merely

"open for discussion"

continued

get a lick and a promise in terms of job survey, design of layout, and completeness of steam piping, condensate handling, temperature control, and provision of future maintenance.

B. R. Small
Staff Engineer
Aluminum Co. of America
Pittsburgh, Pa.

Use Check Lists to Impress Client With Complexities of Construction

The Data Sheet *Heating, Ventilating, and Air Conditioning Check Lists for Coordinating Drawings*, by John W. Habjan (January), is of particular interest to me since I have been thinking of a similar approach to the problems of errors and omissions for quite some time. Mr. Habjan has certainly spent a great deal of time in trying to make his lists all-inclusive.

However, it is my opinion that his check lists will be most useful to young engineers who are just beginning to accept the responsibility of producing a complete set of working drawings for a building. Successful engineering can never be reduced to fixed formulas and check lists; however, such lists can at times make engineering easier by reducing the amount of concentration required to coordinate the mechanical engineering design with the architectural, structural, and special equipment designs.

The check list might also be useful as a ready reference when it becomes necessary to impress a client, who is usually inexperienced in the complexity of building construction, with the desirability of following an orderly procedure and allowing a reasonable time for the design drawings. All too often a project can be discussed for years with a client with no decisions, but the instant the decision is made to proceed with working drawings time often becomes of the utmost importance. At this point the engineer could well send his client a copy of the check list. I'm sure his work would be better understood.

Mr. Habjan certainly summarized the function of this article when he stated that drafting omissions, dimensional discrepancies, etc., almost always lead to job delay and extra costs during construction.

H. J. Scharres
Associate
E. R. Gritschke & Associates, Inc.
Consulting Engineers
Chicago, Ill.

New Chilled Water Coil Selection Method Should Be Real Time Saver

Regarding the article *Here's a New, Quick Way to Select Chilled Water Coils*, by Bruno P. Morabito and William Conroy (January), we know that for many years people have worked out different methods of direct selection for specific sizes of units and coils and that a considerable amount of time can be saved for consulting engineers and contractors when such tables and charts are worked out. This method apparently is a different concept than has been used previously and undoubtedly has considerable merit.

We believe one of the biggest points in this article is the section headed "Checks Leaving Conditions, Aids System Design" wherein it is pointed out that any particular coil has a definite surface configuration, and as a result, sensible and total capacity. Engineers have known for some time that if they could obtain a heat transfer surface which would more closely meet specified sensible and total requirements that they could reduce, in some cases, the compressor size required. We believe that because the surface which is offered in this quick selection method provides two ratios of secondary to total surface that that is the reason, in most instances, that they can reduce their refrigeration machine size, although in some cases, the method of selection may have some bearing also.

We believe this is a step forward and, as with most new developments, probably has a few minor items to be ironed out, but that the final result should be better than what has been used in the past.

W. B. Buck
Field Sales Manager
McQuay, Inc.
Minneapolis, Minn.

Compare Electric Heating Systems, Combustion Systems on Same Basis

Denard L. Gusler's article on school heating (October 1958) is a very interesting one. It is gratifying to see articles of this nature. Discussion of electric heating and an evaluation of it should prove very informative to many architects and engineers who have not as yet considered it for space heating.

Experience with many electrically heated schools has shown us that many influencing factors, which must be considered in making a fair comparison of electric *vs* combustion type systems, are often not considered at all. These include:

1) Higher first costs for combustion type systems which must be considered by including the first cost difference or additional "owning" costs (depreciation, interest, insurance, etc.) in the yearly cost of operating the system.

2) Distribution and standby losses, which occur in fuel fired systems, are not present in electrically heated schools where the heat is produced at the location requiring it. Standby and piping losses are not included in the 70 percent "burning" efficiency often used for oil fired equipment. They should be included, however, by using a lower and more realistic efficiency in the fuel consumption calculation or by increasing the heat loss figure in the case of the combustion system only.

3) Maintenance of combustion heating equipment is always greater than for electric equipment. It must be recognized that mechanical equipment is inherently more prone to deterioration due to wear, corrosion, lack of proper adjustment, etc. It is obvious that combustion equipment will require periodic cleaning of combustion chamber and surfaces, breeching, chimney, strainers, chemical treatment of boiler water, etc. In addition, adjustment of draft and ignition, and periodic replacement of nozzles are regular parts of oil system care. None of these are present in electric heating systems.

4) Life expectancy of combustion type equipment may possibly exceed electric equipment, but this is unlikely. Experience is already showing the reverse to be true. Even if combustion equipment did outlast electric equipment, consideration should be given to the degree of maintenance necessary to achieve this. In the case of electric equipment, no maintenance is necessary or even possible to produce longer life. Consideration must also be given to the difficulty of replacement. Replacement of electric elements, which would most likely fail one at a time, is far simpler than retubing a boiler or replacing pipe. It must be remembered also that much of the first cost of electric heating is wiring which, for all practical purposes, may be considered permanent.

Although electric school heating on a large scale is relatively new, many systems are already installed and performing satisfactorily. Many more are underway or in the design stage and it is only a matter of time before school boards throughout the country will have an abundance of concrete evidence of electric heating practicality and attractiveness. When this experience has been tabulated we will be able to say "here are the actual results." In the meantime, the electric industry will continue to assist engineers and architects as well as their clients by making available to them its experience with electric heat.

Robert E. Matthews
Air Conditioning Div.
American Electric Power Service Corp.
New York, N.Y.

Sensation of Odor Is Only One Effect Vapors Have on the Human Body

Several of us here have read Albert B. Hubbard's *Winning the Air Conditioning Odor Fight, Round I* (January) and feel that it is an excellent opening for the subject. I'm going to make a few comments which are not criticisms at all because they contradict nothing he has said. They only elaborate and it is possible that he may touch on the same points in later articles.

The sensation of odor is only one effect on the human body of many vapors, particularly the vapors of volatile organic compounds. In some cases, odor is the primary effect on the human body; in others, this is not so. Some compounds can have relatively weak odors and perhaps even pleasant odors but can have other detrimental effects on the body. An exaggerated example would be hydrocyanic acid gas. This has a pleasant enough and not particularly strong odor. But it is deadly. Ozone has a sort of refreshing odor but it has been shown to be poisonous even in low concentrations. The effect of organic vapors may not be poisonous but could cause discomfort and other undesirable symptoms. Some compounds or mixtures of compounds have almost no odor at all, but might be poisonous or undesirable to some degree.

It is recognized by people working in this field, although probably it has not really been proved scientifically, that concentrations of typical odor-causing materials below the threshold point can cause the sensation of stuffiness. As soon as these compounds are removed from the air, the stuffiness disappears.

The human body has a tendency to adapt itself to odors so that after a period of time the odor is no longer perceived or at least it does not appear as strong. However, other effects on the body may be cumulative. Although the sensation of odor may be gone, the human body may experience the feeling of stuffiness, drowziness, or even worse effects.

H. L. Barnebey
Barnebey-Cheney Co.
Columbus, Ohio

More Investigations Should Be Made Of Low Alloy Steels for Reactors

In his article *How to Avoid Piping Corrosion In Nuclear Reactor Plants* (December 1958), W. Z. Friend presents a very informative survey of some of the piping corrosion problems that exist in these plants. His description of the use of specific materials is complete, including the use or non-use of the stress relief anneal for austenitic stainless steel welded pressure vessels.

It is interesting to note that stress relieving of large complex heat exchanger vessels of the nonstabilized Series 300 stainless steels does not always result in a reasonably stress-free piece of equipment. It is known in the metallurgical industry today that alloys not stabilized with titanium or niobium-tantalum should be cooled through the range of approximately 1800 to 1000 F in less than 3 min and the same rapid cooling rate should be continued until the vessel has been cooled below approximately 800 F. It is also understood that slightly slower cooling rates may be satisfactory for the low carbon and stabilized types. However, vessel size and complexity requiring extended heat treatment would no doubt necessitate a very careful procedure in bracing and supporting the vessel during the heat treatment cycle. This procedure would assist in elimination of buckling and distortion, but would no doubt introduce areas of restraint with attendant stresses.

"open for discussion"

continued

Admittedly, stress-corrosion cracking is a problem in the secondary systems of nuclear power stations. Annealing of the austenitic stainless steels is one of the means of combatting this phenomenon. Yet, it can never be completely assured that vessels or other equipment are stress relieved to the point where the equipment is not likely to develop thermal expansion stresses since the very act of bracing a stainless steel vessel during a solution or stress relief anneal can introduce restraints which would be magnified during service.

Mr. Friend suggests an alternative to the use and stress relieving of large austenitic stainless steel vessels, which is a much more realistic approach to the stress-corrosion cracking problem. Specifically, he points to the use of the high nickel alloys which show complete resistance to stress-corrosion cracking in all of the chloride atmospheres which may cause cracking of the austenitic stainless steels. It is suggested that the high nickel alloys be exploited to the fullest extent so that their costs may become more competitive with the austenitic stainless steels.

Mention is made of the possible use of carbon and low alloy steels for water cooled nuclear reactors. It is my opinion that carbon and low alloy steels should be more fully investigated than is being done at the present time to implement their use in reactor systems for both secondary and primary loops. These materials do not generally show any susceptibility to chloride stress-corrosion cracking and have been proven in conventional steam-electric stations to be suitable in water and steam service up to 1100 F. Consequently, with the enigma of high cost always appearing prior to and after any reactor design for a power station, it would seem relevant to develop the use of these lower cost steels. The necessary water purification systems to eliminate scale and other corrosion products from the reactor core resulting from the use of carbon and low alloy steels must be exploited further.

J. A. Klapper
Metallurgical Engineer
Ebasco Services, Inc.
New York, N.Y.

Laud Swedish Engineers' Ingenuity In Designing Garage-Shelter

Axel Rosell's article *Swedish Air Raid Shelter Ventilation Designed for Atomic War Emergency* (September 1958) is an interesting dissertation on a superb installation. The outstanding achievement of engineers in Stockholm of constructing defense shelters which in peacetime have a utilitarian purpose cannot be praised too highly. It represents the realization of a proposal sponsored in 1949 by Herbert Behnke and subsequently incorporated into Congressional legislation (but not implemented) to combine the long range objectives of national defense with the urgent need of municipalities to solve their automobile parking problems. In the U. S. we have yet to take action with regard to this prime defense measure.

It is noted that in the Swedish garage-shelter provisions have been made to solve critical problems not only pertaining to blast and other effects of nuclear weapons, but also to protection against gas contamination. Apart from certain ingeneous adaptations possible with regard to ventilation, attention has been given to the self-contained atmosphere, although oxygen and provision for carbon dioxide absorption are not available at the present time.

In nuclear-propelled submarines, a completely recirculated atmosphere has been maintained for periods as long as two months. The air revitalization process has in fact been so effective that personnel emerging from the artificial atmosphere have complained about the odors of the natural seaside atmosphere.

Some remarks may be in order concerning shelter supplies and habitability techniques. The solution of the water supply problem is especially commendable. In public shelters, such as subways, water is a limiting factor to prolonged habitation because of lack of availability and storage difficulties. For adults who are not sweating, minimal daily requirements can be reduced to about 3 pints. For personal hygiene, particularly in protecting the skin against bacterial and fungal pathogens, remarkably small amounts of denatured alcohol containing fungicidal medication suffice for extended periods of close confinement.

With respect to food, an amazing simplification is possible by using such dry rations (capable of prolonged storage) as milk powder, vegetable oil, processed carbohydrates, peanut bars, and vitamin supplements. Such items of diet in amounts of less than 1 lb per day will maintain health, and well-being of adults for periods of 30 days or longer. Dehydrated meats wrapped in cellophane (and capable of storage at room temperature for many months) can be reconstituted in small quantities of water. If minimal cooking is permitted, such meat, boiled for about 2 min with bouillon cubes to provide additional flavor, is highly palatable and especially satisfying as an additional source of animal protein.

Use could be made of the parked automobiles for storage not only for dry food rations, but also for essential medical supplies. Thus, the garage-shelter could also function as a medical dispensary.

In conclusion, a simplified diet and some habituation to shelter living can keep individuals in good physical condition, especially if meticulous attention is accorded personal hygiene. Prolonged confinement even in excess of 10 days need not be attended by hardship if the subsidiary items mentioned are given commendable planning.

A. R. Behnke
Captain MC, U.S.N.
Radiological Medical Director
U.S. Naval Radiological Defense Laboratory
San Francisco, Calif.

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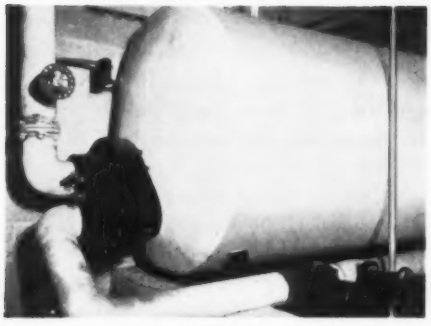
TWO RECO CEMENT-LINED HEATERS SERVE NEW GALT OCEAN MILE HOTEL



From window glass to heating system, *quality* was the keynote at the beautiful new Galt Ocean Mile Hotel. This luxurious $3,000,000 building is the first of 25 new hotels to be built on a one mile, $19,000,000 stretch of beach inside the city limits at Fort Lauderdale, Florida.

Of course *delivery* and *price* were important factors, too. Two RECO Cement-lined Hot Water Storage Heaters (48″ x 192″ and 48″ x 264″) "more than adequately" met all three of these requirements according to William D. Cross, Mechanical Contractor.

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RICHMOND ENGINEERING CO., INC.

question of the month

"How Can Leak Be Detected Under Concrete Floor Slab?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

"We are having trouble finding a leak in a radiant heating system which is installed under a concrete floor slab. The system was put in approximately 10 years ago. So far, in trying to locate the leak we have used a sonic detector with earphones, and have also drilled holes in the slab in the suspected area hoping that the presence of excessive moisture in the ground might lead us to it. Both of these efforts have been to no avail.

"Any suggestions from readers on how this leak might be located will be appreciated."—S.L.L.

Iodine Radioisotopes Added to Water Cause Gamma Radiation at Leak

ONE SOLUTION to S.L.L.'s problem was described in the brief but excellent article, *Detecting Leaks with Radioisotopes* (November 1955). It shows how radioisotopes have been used successfully for detecting leaks, particularly in a radiant heating system installed under a concrete slab.

The article advises that a commercial laboratory conceived the idea of adding one to two millicuries of iodine^{131} to the water in the heating system. The floor was explored systematically with a Geiger survey meter, and the position of the leak was found rather easily because of the large increase of radioactivity resulting from the gamma radiation in the water surrounding the leak. All that was required then was to remove a section of the concrete floor slab approximately 6 in. in diameter to find the break.

It is possible that other radioisotopes may be used; however, the advantage of iodine is that it has a relatively short half life (eight days) and a fairly high gamma energy (up to 600,000 electron volts). A Geiger counter can detect radiation given off by the radioactive iodine through several inches of concrete.

The user must apply for a license from the Atomic Energy Commission, specifying the amount of radioactive iodine needed and its contemplated use.

HAROLD BAVLEY
Senior Engineer
The Commonwealth of Massachusetts
Dept. of Labor and Industries
Div. of Occupational Hygiene
Boston, Mass.

Variations In Vapor Transfer Rates May Be Key to Locating Pipe Leak

ONE METHOD of locating the approximate spot or area of the leak (or leaks) is to determine whether or not there is a variation in rates of water vapor passing through the slab from the ground side to the interior side. I have no knowledge of this method ever being used, but see no reason why it should not work.

It is an established fact that all building materials, except the most effective vapor barriers, permit the passage of water vapor. Rates of passage depend on the nature and thickness of the material. Permeability

Ellicott offers a complete range of metals and linings customized to control most types of corrosion in Hot Water Generators.

COPPER SILICON—offers outstanding resistance to corrosion under practically all conditions.

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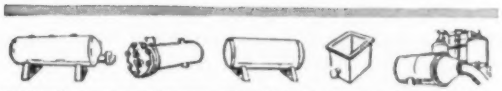

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of concrete may vary upwards to 4 gr per hr-in.-sq ft-in. of mercury vapor pressure.

If there is liquid water directly under a portion of the concrete slab, it would be reasonable to assume that the water vapor migration rates through this portion would be higher than the remaining area because of the higher vapor pressure differential across slab surfaces at that point.

The problem is to locate the spot or area that is higher than the slab's established average. An instrument may be used to determine this variance. One such instrument is an electric hygrometer indicator, which essentially measures relative humidity. But when used with a special cup like attachment, it can be used to indicate a variance of water vapor migration rates.

The floor in question would be divided into squares and readings taken of each square by placing the cups directly on the surface, thus isolating the relative humidity sensing element from surrounding room air. A moisture buildup within the cup results. After equilibrium has been reached, the higher relative humidity readings would indicate areas where the leak may be.

All readings must be taken under the same ambient dry and wet bulb temperatures. The readings then could be plotted on linear graph paper and studied. Areas of higher than average relative humidity readings would indicate the area where the leak is likely to be.

An alternate method would be to drain the system and refill it with refrigerant No. 12 gas. The gas pressure within the slab piping could be maintained at a desired level by feeding directly from the refrigerant supply flask and closing shutoff valves in the system. The top surface of the concrete slab would then be searched with a refrigerant leak detector to determine the approximate location of the pipe leak.

R. J. Zablodil
Director
Heating and Ventilating Div.
U.S. Naval Civil Engineering Laboratory
Port Hueneme, Calif.

Radioactive Tracer Element Is Answer; But User Must Be Licensed by AEC

If the magnitude of the problem justifies the time, effort, and expense required, S.L.L. can locate the leak by introducing a radioactive tracer element into the system and searching for it with a Geiger counter.

Briefly stated, the procedure consists of adding enough of a high specific activity, hard gamma emitter radioisotope to the circulating water in the system to raise the counts above "background" so the radiation can be detected by the Geiger tube when it is passed along the floor over the pipes. At the point where the leak has occurred there will be a large increase in the counts detected by the instrument due to the "ponding" of the radioactive liquid around the leak. Normally the location of the leak can be determined within 1 ft when, as S.L.L. indicates, the slab rests on the ground.

Radioisotopes are sold by the Isotope Sales Dept., Oak Ridge National Laboratory, Union Carbide Nuclear Co., Oak Ridge, Tenn. Only persons holding a license issued by the U.S. Atomic Energy Commission, Washington, D. C., are eligible to purchase radioisotopes, however. These licenses are limited to persons who are technically trained, have knowledge of the proper handling and disposal of radioactive materials, and have the use of the required safety monitoring equipment.

Numerous graduates of the Oak Ridge Institute of Nuclear Studies now working in hospitals and universities throughout the country are qualified to make this survey with slight delay and at reasonable cost.

G. W. T. Kearsley
Mechanical Engineer
Oak Ridge, Tenn.

Inject Refrigerant into System; Expansion Will Cool Slab at Leak

My suggestion is to isolate the suspected section of piping, drain the water, and introduce refrigerant No. 12 using the same procedure as in charging a refrigerant system. If the pipe leak is sufficiently small, expansion of the refrigerant will cool the slab in the area of the leak. Floor surface temperature measurements can be made to obtain the location more accurately. Should this prove fruitless, try using a halide torch to detect the source of the leaking refrigerant.

Of course, it is necessary that the section of piping to be charged with refrigerant is free of all moisture. Otherwise, freezing may occur and plug the leak, preventing release of the refrigerant.

Jack M. Bane
Mechanical Engineer
Chevy Chase, Md.

Suggest Using Dye, Fluorescent, Oil-and-Whiting, Ultrasonic Methods

Several methods are available for locating leaks as described by S.L.L. Among these are: dye, fluorescent, and oil-and-whiting penetrant tests as well as ultrasonic vibrations.

With the first method, a liquid penetrant containing a coloring agent is passed through the piping system. A short time period is allowed for the fluid to soak into any surface separations that are present. Excess penetrant is removed and a "developer" is circulated through the circuit. Any liquid remaining in fissures or cracks will be absorbed into the pores of the developer by capillary action.

Fluorescent penetrant testing uses the same proce-

dures as the dye penetrant process except the penetrating oil contains a fluorescent additive. The latter permits detection of surface irregularities by viewing with a "black" light from a portable lamp.

Oil-and-whiting testing, a time proven method, uses a similar technique. Penetrant testing offers advantages

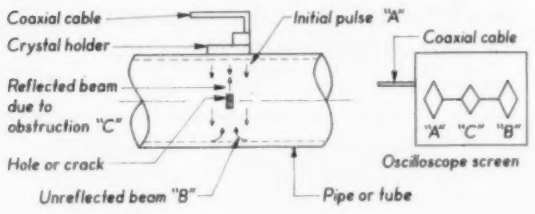


Fig. 1

of application ease, provides quick results, does not require services of a highly skilled operator, and avoids need for expensive and bulky equipment.

With ultrasonic testing, vibrations of approximately 100,000 to 10 million cps are transmitted by a piezoelectric effect through the pipe or tube material. Results of these vibrations are observed on an oscilloscope. Any discontinuity of the material interrupts passage of the impulse passing through the material and is indicated by the wave form on a viewing screen. Fig. 1 shows details of this method.

With this technique, a choice of two types of beams are available. A straight beam allows sound waves to travel straight through the pipe or tubing, bounce off

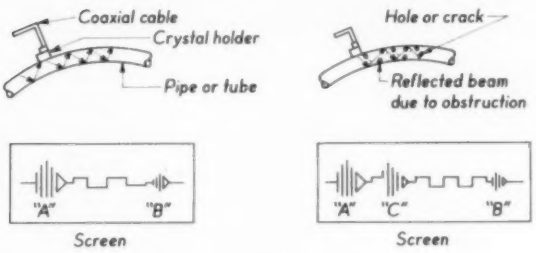


Fig. 2

the walls, and again be picked up by the search unit. With the angle beam unit, the hookup allows sound waves to ricochet off all sides of the piping. For this reason it is well suited for curved members such as elbows and bends. Fig. 2 shows these relations.

H. B. Wayne
Consulting Engineer
Woodhaven, N. Y.

Failure of Sonic Detector Indicates Leak Is Small, Flow Is Laminar

Since the use of a sonic detector with earphones does not disclose the location, the leak is apparently small and the flow is laminar. Possibly a good automobile

question of the month

continued

radiator sealer will stop the leak. Or, another method is to cause turbulent flow such that the sonic detector will function.

C. M. E. Hoffman
Engineering Consultant
Boiler and Accident Prevention Div.
Maryland Casualty Co.
Baltimore, Md.

Introduce Radioactive Substances; Trace Piping with Geiger Counter

Radioactive substances can be employed as a solution to S.L.L.'s problem. The procedure simply involves introducing a few parts per million of this radioactive material into the heating system and, with a Geiger counter, tracing the piping to pinpoint the leak. The location is readily indicated due to the concentration of radioactivity that has developed there.

Donald F. Ingram
Sales Engineer
Johnson Service Co.
Jackson, Miss.

Quick Slab Temperature Change Will Create Condensation, Reveal Leak

One method of finding leaks in the hot water coils in the slab is to utilize the principle of condensation. To create the conditions for condensation, shut down all delivery of hot water to the pipes. In the meantime, have the boiler going. When the structure is good and cold, open the valves and permit the hot water to flow through the pipes. This rapid change will cause moisture to condense on the slab, thus outlining the pattern of the heating coils. Where the leak occurs, an irregular pattern will become visible on the slab directly over the rupture in the coils.

After repairing the leak, further breaks in the system can be avoided by checking to see if there are the proper number of expansion joints.

If these were not originally built into the system, something has to give.

Thomas S. Terry, Jr.
Engineer
New York, N. Y.

Tracing of Radioactive Material Is Quickest, Most Economical Way

I think the quickest and most economical method would be to use a radioactive material in solution and inject it into the heating system, then use a Geiger counter on the floor area. Any leaks will readily show up and the Geiger counter intensity will pinpoint to the source of the leak. The pump should be turned on for system circulation.

Most analysis laboratories can recommend a mate-

rial that would be suitable yet harmless enough to handle for the purpose. The system should then be thoroughly cleaned.

GARD C. MACALARNEY
President
Soisson, Inc.
Mechanical Contractors
Cresson, Pa.

Put Piping System under Pressure; Resume Search with Sonic Detector

I SUGGEST that the boiler be blocked out of the piping system and a static water pressure — as much as the valves can stand — be applied to the piping. (I test my piping systems at 300 psi.) This done, S.L.L. may have better luck with his sonic detector.

By closing the zone valves it will be possible to apply the pressure to both the supply and return piping and, by means of a pressure gage on each side, isolate the leak to that extent.

FRED KULL
Consulting Engineer
Monroe, La.

Find Circuiting, Cool Slab, Start Pump, Feel Floor for Hot Spots

I HAVE been called to locate and repair just such a leak as described by S.L.L. I found the leak in the following manner: First, I determined the circuit by valving the supplies and returns and trying them out one at a time. Then, I shut down the pump to allow the slab to cool. When the temperature of the slab had dropped sufficiently, I set the thermostat high, started the pump, and started feeling over the slab for hot spots. This was quite a lot of work, but we uncovered the leak at the first try.

EARL PETERSON
Peterson Plumbing & Heating Co.
Minneapolis, Minn.

Don't Pump Water; Let Radioactive Substance Explore Its Way Out

ADDING a radioactive substance to the water and tracing its path with a Geiger counter to locate underfloor leaks is a proven solution. In using this procedure, I would suggest that the water not be pumped. Instead, merely inject the substance into the system, maintain water pressure in the system, and let the substance find its way out through the leaks.

STEPHEN G. FLANNAGAN
Mechanical Engineer
Eric G. Flannagan and Sons
Architects and Engineers
Henderson, N.C.

First Determine What Caused Leak; This May Be Key to Finding It

S.S.L. MIGHT find the answer to his problem by asking himself the question: What *caused* the leak? If the concrete slab has settled and cracked, it is quite possible that the leak is located along the crack. Or, if the slab has expanded and contracted too much, he might check his high spots or expansion joints. If it is practical, he could channel under the slab at different spots and work from the bottom up.

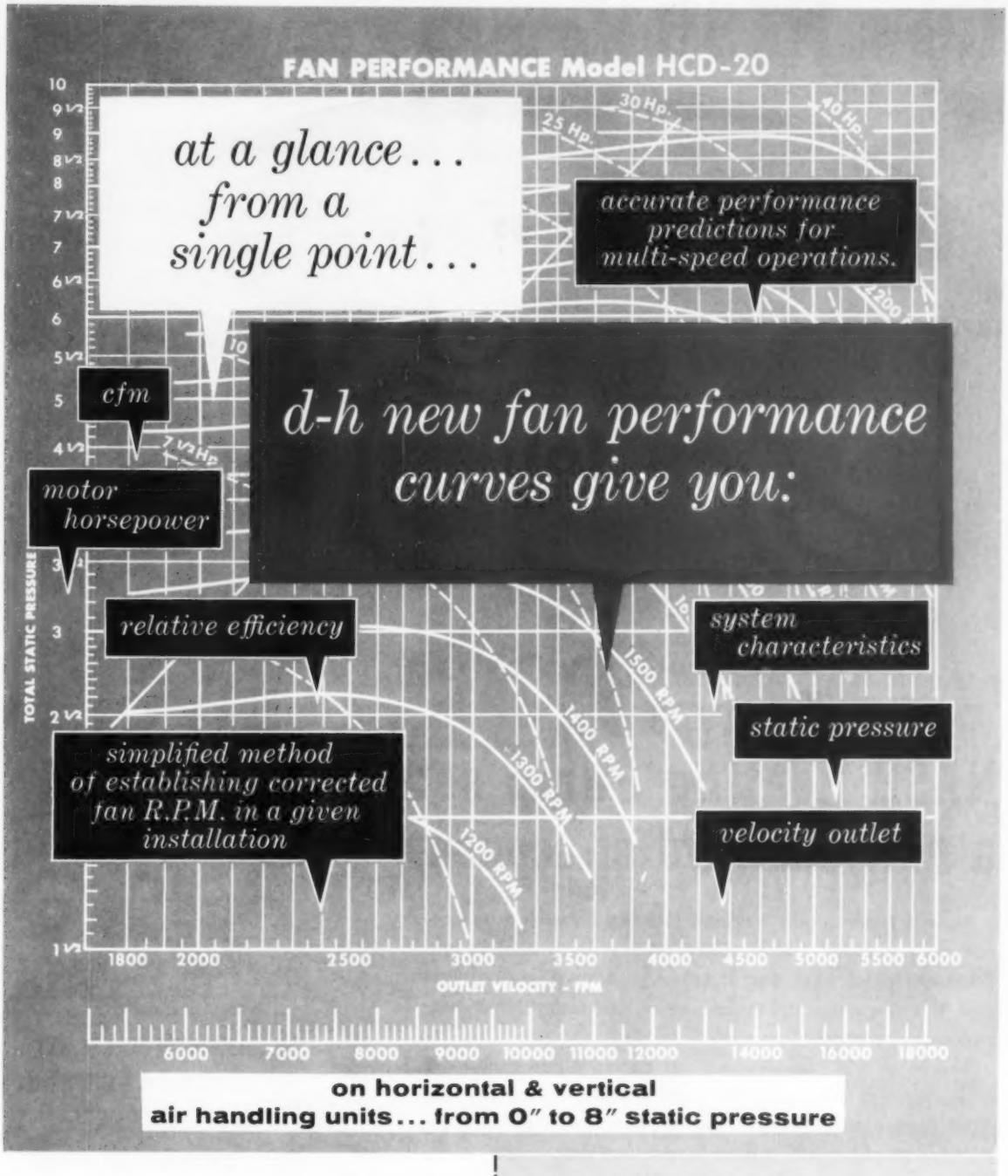
ROBERT J. STAHLE
New Cumberland, Pa.

READER ASKS—

"What Are the Economics of Supporting Pipelines Outside Plant Buildings?"

"I am in need of information on the subject of the economics of supporting pipelines outside of plant buildings. Any studies or reports that have been made on this subject with reference to pipeline arrangements, types and heights of supports, and the method of hanging and supporting the pipes would be helpful."—O.S.P.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*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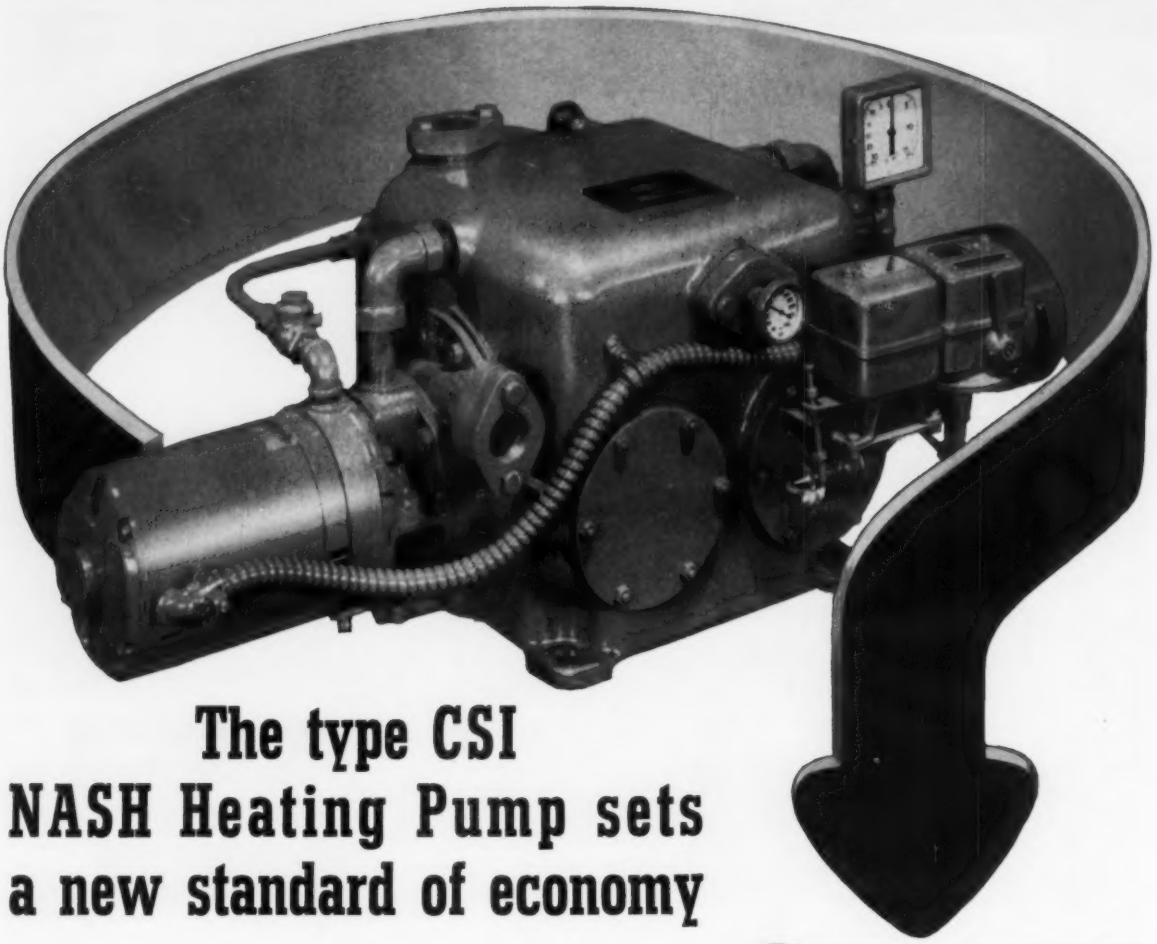

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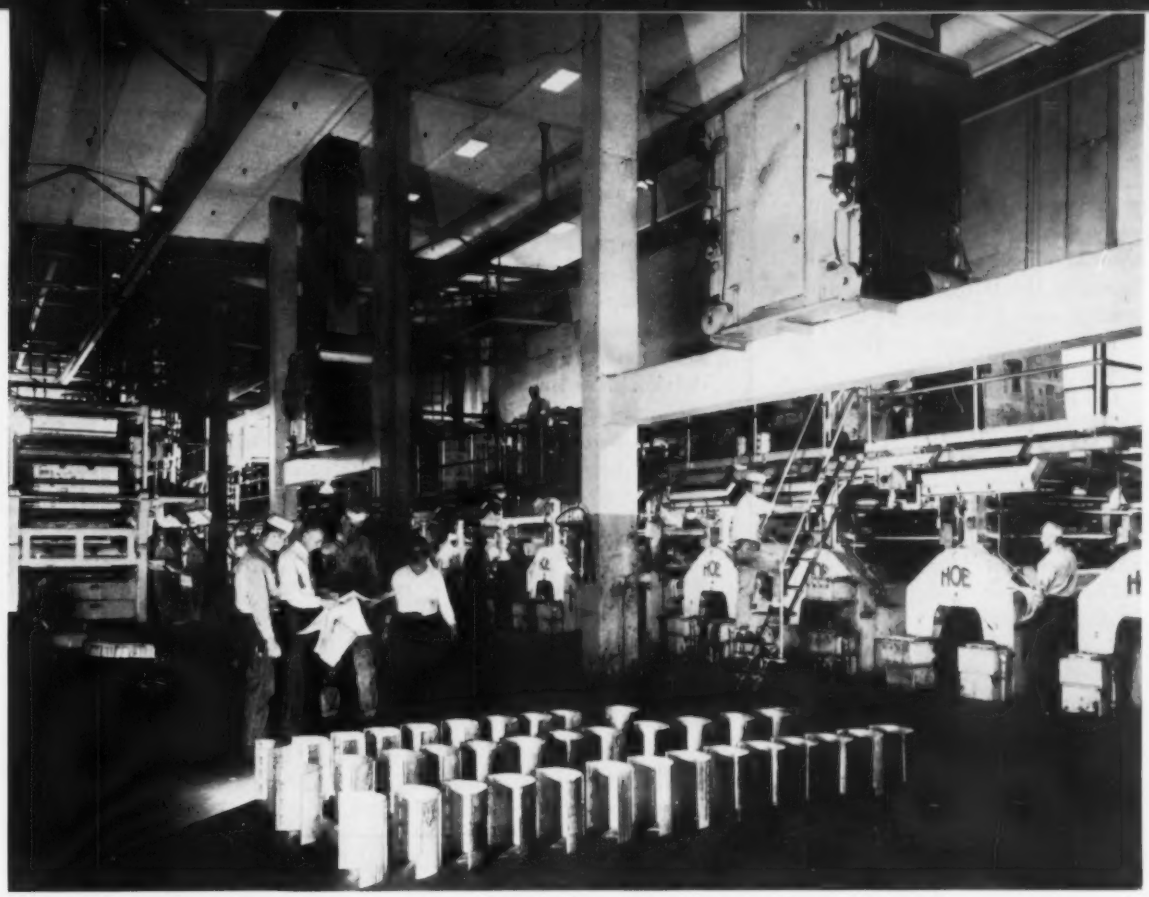


PRESSROOM VENTILATOR is designed to exhaust ink mist from high speed rotary presses before it accumulates on walls. Ventilation air is distributed by supply mains above ceiling. Branch ducts drop to reel level, where air is discharged through registers. Stereotypes, on floor in foreground, present another problem when they are remelted in foundry. Oil mist laden air from pots is conveyed at high velocity to water spray at exhaust fan. Air is thus washed to insure clean exhaust

Varied Central Systems Cool, Heat, Ventilate New Boston Globe Plant

. . . to serve a daily newspaper's diversified production needs

BY W. JOSEPH STANLEY
and
STANFORD E. CLOCK
Mechanical Engineers
Ganteaume & McMullen
Engineers and Architects

AFTER 85 years on historic Newspaper Row, the Boston Globe has moved into a new $12 million home. The structure, five years in planning, is one of the most modern newspaper plants in the country and encloses 344,000 sq ft of floor space.

The building comprises three separate structural units — an office production section, a pressroom section, and a paper storage section. These are separated by expansion joints.

The office production section has three floors, with a mezzanine level between the first and second. On the first floor are the entrance lobby,

composing room, photo-engraving department, and stereotype job room.

Employee's locker rooms and the stereotype foundry are located on the mezzanine level. Administrative and editorial offices are on the second floor. On the third are a cafeteria (with a seating capacity of 275), a recreational area, and the air conditioning equipment room.

The pressroom section is the same height as the office production section, containing two press lines totaling 37 presses which have a printing capacity of 52,000 newspapers an hour. Provisions have been made for a third press line later.

The paper storage section is a single-story unit at the rear of the building. Here, the Globe can store 5700 rolls of newsprint. Spur tracks enter this area, with accommodations for 10 freight cars. Newsprint and ink are received from these tracks.

● The wide variety of heating, air conditioning, and ventilating requirements—of office areas, composing room, pressroom, foundry, newsprint storage, and other facilities—at the Boston Globe's splendid new $12 million plant are met by a well integrated arrangement of built-up mechanical systems. Administrative and editorial offices are air conditioned the year 'round by fan coil perimeter and interior zoned systems. Newspaper production areas are heated, conditioned, and/or ventilated as necessary — to compensate for heat producing equipment, to exhaust ink mist thrown off by high speed presses and released from foundry melting pots, to maintain proper humidity levels for paper storage, and to perform a number of other functions vital to the operation of a modern daily newspaper.

Mr. Stanley is a graduate of Lowell Institute. Joining Ganteaume & McMullen in 1950, today he is head of its mechanical department.

Mr. Clock, a Wentworth Institute graduate, was with Ganteaume & McMullen for eight years as a field engineer and chief design engineer of heating, air conditioning, and ventilation systems. In 1957 he became associated with the Merrill Co., Boston mechanical (heating, piping, and air conditioning) contractors.

What Factors Affected Design?

The owners, naturally, selected the areas they wished to have conditioned, after receiving approximate costs for conditioning all areas of the plant. In spaces selected for conditioning, the prime consideration was centralization of systems, to take advantage of economies derived in plant and equipment maintenance. Conditioned areas were zoned by taking into account concentrated heat loads being produced in individual rooms or spaces.

With centralization decided, it was determined that a chilled water system would be the cooling medium, and primary or ventilation air would be treated by cooling coils or a similar method.

To compensate for exterior zone heat gains or losses, fan coil units were selected, since they made possible a year 'round temperature control system.

Architectural treatment called for moveable partitions in all office areas. With fan coil units it would be possible to relocate or replace units with larger or smaller ones at a minimum cost, if partition changes occurred, without necessitating changes in quantity of primary air.

The first consideration was given to a chilled water coil with a three-way valve control and with winter humidification provided by means of an air washer.

Logically, it followed that if an air washer having chilled water were used, excellent dewpoint control could be obtained for summer conditioning, and the coil would not be necessary. Accordingly, the piping was arranged with proper valve controls for introducing fresh chilled water makeup and returning "used" water to the central system accumulator tank. This arrangement obviated the use of cooling coils and the expense of their maintenance.

In only one instance was a cooling coil used in conjunction with an air washer, and that was for the primary air serving the exterior zones. The exception was made in order to gain the increase of heat transfer rate when the cooling coil was sprayed with water. This permitted the space requirements for the air handling equipment serving these zones to be smaller in size than would otherwise have been possible.

The pressroom area was not to be air conditioned. With high speed presses in operation it is possible — even with rubber rollers — to build up a static electric charge. To overcome this it was decided to maintain space relative humidity conditions at a minimum of 50 percent the year 'round, using an air washer.

Also, for fire protection purposes, all exhaust air from the pressrooms is filtered. Without filtering, paper lint impregnated with ink would soon coat the interior ductwork to form a hazardous fire condition and present a difficult maintenance problem. In addition, the discharge at the roof would cover the roofing with an oil coating that would be both fire hazardous and detrimental to the roofing.

In the paper storage area, space conditions are maintained at 72 F and 50 percent RH. Newsprint comes in rolls approximately 5 ft long and 36 in. in diameter, weighing 1400 lb.

During manufacture at the paper mill, conditions are maintained at approximately the same temperature and humidity levels. For shipping, the rolls are wrapped with heavy

After 85 years on Boston's Newspaper Row . . .

NEW HOME of Boston Globe mirrors the latest in newspaper publishing efficiency. Key components are variety of mechanical systems which supply air conditioning, ventilation, heating according to needs of specific areas

paper to keep out moisture and prevent excessive drying.

At the newspaper plant, the rolls are stored under the same conditions as exist in the manufacturing of the newsprint. Dried out edges or checking of a newspaper indicate a dry storage and pressroom. This checking or cracking of newsprint edges could easily allow the web of the paper to be fractured during printing, thereby causing a press stoppage. Humidity control for newsprint is therefore essential for both storage and printing.

Condition Entire Office Area

The office production section is air conditioned throughout. The cooling capacity totaling 600 tons is provided by two hermetic centrifugal compressors rated at 300 tons each.

These units supply 45 F chilled water to five central built-up systems. A two-cell, induced draft cooling tower supplies condenser water.

All of the air conditioning equipment is located in the equipment room on the third floor. Chilled water is circulated in a loop around the room. From this loop it is supplied to the five built-up air handling units. Four of these — first floor, second floor, cafeteria, and composing room — have capillary cell air washers. The fifth unit — for the perimeter offices — has a cooling coil in addition to its air washer.

Chilled water is also supplied from the loop to pumps which serve three closed systems of circulating piping for remote air handling units in the composing and etching rooms and for the fan coil units that serve the perimeter offices.

The perimeter air system is comprised of three zones — east, north, and west — which supply conditioned ventilation air to all of the perimeter offices on the first and second floors. The air supplied to each room is conditioned by a capillary cell air washer with a chilled water cooling coil.

Outside air is brought in through a preheat coil and a roll type glass media filter. It is then cooled to the proper dewpoint temperature, as determined by an outside master thermostat, through a dewpoint controller that actuates a three-way chilled water valve at the cooling coil.

Fans for each of the three zones deliver air, after it has passed through reheat coils controlled by outside thermostats (one for each zone exposure), to the office diffusers. Water in the air washer is recirculated.

Fan Coil Units Serve Perimeter

In addition, each of the perimeter offices has fan coil units that are supplied with circulated water from pumps in the equipment room. This water is either chilled or heated, depending on outdoor temperature conditions. A steam heated converter brings the water up to temperature.

The changeover from chilled to hot water is controlled by an outside master thermostat which modulates the pneumatic valves in the chilled water supply and return lines for the fan coil system to a closed position.

Foundry area has an exhaust system of ventilation. All air exhausted comes from the composing room. Since this is conditioned air, it will provide secondary cooling in the foundry area.

The steam supply valve at the converter is modulated to a full-open position.

A three-way valve at each fan coil is controlled by a recirculated air thermostat. Each fan coil unit has a three-speed fan switch. This combination gives each office a good selection of individual control.

Interior Areas Zoned

The interior systems for the first and second floors comprise two and four zones, respectively, and are similar in air treatment arrangement. The first floor system supplies the photo-engraving area. The composing room, also on the first floor, has its own system. The second floor system supplies the administrative and editorial interior offices.

Both of these systems bring in outside air through a preheat coil and then mix it with return air. The mixed air passes through a roll type glass media filter and enters the capillary cell air washers. Each washer is supplied with chilled water from the main chilled water loop. A pneumatic valve, controlling chilled water supply to the air washer sprays, is modulated by a dewpoint controller. As in all of the systems, the controller is reset by a master outside thermostat. The chilled water is pumped back to an accumulator tank.

When the outdoor temperature falls, the chilled water supply, together with the return water valve in the line to the accumulator tank, closes to prevent the entrance of chilled water to the washer and the return of the water to the tank. The air washer pump then recirculates the washer water through the sprays for humidity control during the heating season.

During the cooling season a pneumatic float switch at the air washer tank prevents overflowing by overriding the dewpoint controller. As the water level rises, the pneumatic float switch causes the return valve to modulate toward a full-open position. The conditioned air leaving the washer then passes to a plenum, where zone fans deliver it through reheat coils to their respective areas. The reheat coil steam valves are controlled by zone area thermostats.

The cafeteria has a single-zone system similar to the first and second floor systems. All air is exhausted to the outdoors through hoods in the kitchen and scullery areas. Perimeter fan coil units are used to supplement space cooling provided by the air supply system. Control of these fan coils is similar to that for the perimeter system units.

Four Zones in One Room

The composing room system is also similar to the first and second floor systems except that 100 percent outside air is preconditioned and then delivered to air handling units with cooling-heating coils.

This preconditioned air is mixed with return air at these units. The water to the coils is delivered by the pumps that draw chilled water from the equipment room loop. Since the composing room has an area of 29,000 sq ft and since the heat generated from the linotype melting pots, motors, and other equipment is not evenly distributed throughout this area, four air handling units have been installed to serve the four sections of the room. The water circulation through the coil of each unit is controlled by a three-way valve, actuated by a room thermostat in each of the four sections.

The etching room is an interior room and is a year 'round heat producing area in that it houses seven gas burning stoves, a large gas plate, seven etching machines, and seven powder boxes. This equipment is served by exhaust hoods which help concentrate and exhaust the heat at the source.

Conditioning is required the year 'round. Two air handling units were selected. Both units are supplied with chilled water from pumps in the equipment room. A room thermostat controls a three-way valve at each unit. To prevent corrosion by the nitric acid fumes that are present in a highly diluted form, each of these units is painted with a corrosion resistant paint.

Exhaust Oil Mist From Foundry

The foundry area, at the rear of the composing room, has an exhaust system of ventilation. All air exhausted comes from the composing room. Since this is conditioned air, it will provide secondary cooling in the foundry area.

To carry away the radiated heat, three 10 ton stereotype furnaces have exhaust hoods over their casting boxes. Also, the charging chamber over each furnace's pot is fan exhausted. A metal filter in the exhaust ductwork from the chambers filters out, as much as possible, the oil mist-entrained air that is exhausted from the pots. (The oil mist comes from the vaporized ink that is liberated when the stereotype plates are remelted.) Air from the pots is conveyed at high velocity to a water spray at the exhaust fan, where the air is washed to insure a clean exhaust before it is discharged to the atmosphere. In addition to the duct systems of exhaust, air is exhausted through wall fans to eliminate any smoke or heat that could collect at the roof level above the hoods.

Main problem in pressroom was to pick up ink mist as soon as possible after discharge from high speed rolls and then filter it from the air so that the exhaust to the atmosphere could be discharged relatively ink-free.

The transformer and switchgear vault is an interior room, with access from the pressroom area. It is designed for a supply of ventilation air sufficient to keep the room temperatures below 104 F. But because of the large amount of heat generated by the transformers, which have a total capacity of 10,000 Kva, a tremendous amount of air would have been required to maintain the design maximum temperature. Space for the size of ducts necessary was not available and it was not economical to use chilled water from the air conditioning system.

It was determined that a capillary air washer, to provide evaporative cooling at a 24 F deg temperature differential, could be used. Therefore, whenever the outside air is above 80 F, 100 percent outside air is cooled to 80 F wet bulb at the air washer, passed through a roll type glass media filter, and supplied to the transformer-switchgear vault.

Maintain Positive Pressure

Return air is exhausted to the atmosphere by a fan rated 10 percent less than the supply fan to keep this room under positive pressure at all times. Because the vault is adjacent to the pressroom, positive pressure is desirable, to forestall the entrance of any ink mist into the vault.

When the wet bulb temperature is below 80 F in summer, evaporative cooling is not required, so the air bypasses the air washer. During the winter cycle 90 percent of the air will be recirculated. Heating is not required since the heat liberated by the transformers will be sufficient to maintain 70 F.

This system of air treatment for the vault reduces the amount of outside air required by over 50 percent, thus enabling reasonably sized ductwork to be installed.

Retard Ink Mist Accumulation

The pressroom has a ventilating system designed to eliminate a large percentage of the ink mist from accumulating on the walls. A good deal of time and study was spent and many newspaper plants visited in an effort to design a system that would eliminate the costly cleaning problem that is continually present in pressrooms.

The main problem was to pick up the ink mist as soon as possible after discharge from the high speed rolls and then to filter it from the air so that the exhaust to the atmosphere could be discharged relatively ink-free.

The pressroom has been designed to have 10 air changes per hr under temperature-humidity control. An equipment room, located at one end of the pressroom, houses this equipment. Ventilation air is distributed by supply mains above the pressroom ceiling. Branch ducts drop from these mains to the reel level of the pressroom, where the air is discharged through registers.

Between the two press lines, and just above the presses, are five air exhaust filter assemblies. These consist of two automatic roll type glass media filters mounted in a large plenum. Exhaust air is drawn up from the reel level, through the presses, to the exhaust assemblies, thereby entraining ink mist-laden air within the vicinity of the presses and delivering it to the filters.

Fans, above the pressroom ceiling, exhaust the filtered air from three of these assemblies to the atmosphere. The other two assemblies are connected by ductwork to a fan in the pressroom equipment room. This fan exhausts the filtered air during the summer and recirculates it back to the pressroom ventilation system during the winter. The result is a saving in the cost of winter heating.

The pressroom is kept under a negative pressure by exhausting more air than is supplied. This has been done to prevent any carryover of ink mist to other parts of the plant. Air from a separate unit ventilator is used to supply 40 press motors with outside air in order to keep them free of ink mist.

Install Central Control Panels

To group controls and instrumentation as much as possible, all of the central systems of air conditioning and ventilation have control centers. Each center has a pneumatic control panel where the devices for automatic operation of each system are mounted, with a graphic representation of the system on the front of the panel; a motor control panel, where all of the electric controls for all motor operated equipment of each system have been located; and a 16 point strip recorder for indicating temperature of the various control points.

The paper storage area is heated by four large heating-ventilating units. Air is distributed to the area through ductwork. Space humidity conditions are maintained at 50 percent by a steam distributor located in each unit.

Steam for heating is supplied by three low pressure steel heating boilers. These are fired with No. 5 oil and have rotary type burners and induced draft fans.

The systems were designed by Ganteaume & McMullen, engineers and architects. The mechanical (heating, piping, and air conditioning) contractor was Merrill Co., Inc. ±

Nuclear or Solar Energy: Which Is More Practical for Space Heating?

. . . HPAC's annual report on the fuel situation appraises the potentials of these energy sources to meet tomorrow's heating needs

BY GEORGE W. RUSLER
Chief Staff Engineer
Minneapolis-Honeywell Research Center

IN THE JANUARY issue we discussed the fossil fuel situation in the U.S. and arrived at two conclusions:

1) The depletion of our petroleum reserves will be in a matter of a few decades—not the hundreds or thousands of years that many have been led to believe.

2) Consequently, a fuel shortage is imminent in the next two to four decades.

This is indeed a dilemma. What is the answer? The most apparent possible solutions are nuclear energy and solar energy.

But before considering these sources, let's examine the approximate distribution of uses of fossil fuels in the U.S. These figures, you will see, have a definite bearing on the ability of nuclear and solar energy to meet tomorrow's fuel needs. In 1954, these were:

Space heating	31.3 percent
Industrial process	29.6 percent
Transportation	25.6 percent
Electric power generation	13.5* percent
*Resulting electrical energy at switchboards	3.9 percent

The first two figures are Bureau of Mines data, corrected for the assumption that 25 percent of all industrial fuels are used for heating the thousands of factory buildings. The last two figures are direct Bureau data. The relative significance of these figures should be noted.

Many people have the general concept that electrical power provides a major portion of our present energy requirements and hence most of our energy problems would be solved if this power could be generated from some other fuel.

Unfortunately, this is not a true appraisal of the situation. The above 13.5 percent is the smallest of the four items. Hence, if the fuel demands of all the electric generating plants in the U.S. were shifted today to some other fuel, such as atomic energy, the saving in fossil fuels would be small. Furthermore, because of power plant efficiency, the 13.5 percent represents usable energy at the switchboards of only about 3.9 percent of the total. Assuming no transmission nor other losses, the significance of this latter point is that about 23 *times* the present generating capacity would be required to supply all of our present energy requirements from electrical power.

Fissionable Material Reserves Are Great

Let's now proceed to the consideration of nuclear energy, which embraces both nuclear fission and nuclear fusion.

In considering nuclear fission, a most promising factor is that the energy reserves of fissionable material are estimated at 25 times the reserves of fossil fuels. Moreover, since fission is a demonstrated fact, we might assume that here is a ready source of energy which could be used immediately to either displace or supplement these fuels. Obviously, this would be highly desirable, particularly since fossil fuels are extremely valuable as sources of needed chemicals.

It is recognized that great strides are being made in the development of atomic energy plants. This is very good. But it is feared that the proponents of atomic power are too optimistic about the near term possibilities of major energy contributions from this source. Unfortunately, present published information indicates that there are some major problems to be solved and some major factors to be overcome before major contributions from fissionable energy can be realized. Let us therefore consider the following situations:

Waste Disposal Is Major Problem

The foremost problem in connection with the use of nuclear fission is the disposal of the atomic wastes. The seriousness of this problem is emphasized by the schemes which have been proposed for its solution. Representative of these are proposals to bury the waste in concrete or steel drums and then drop it into the sea, bury it in abandoned oil fields, or project it into outer space by means of rockets.

These solutions, in turn, have their own major prob-

● Solar energy—an "income" energy—could be a sizable source of heating fuel in the next 10 to 20 years if it were actively exploited—*starting now*. This would help conserve some of our capital fuels for more critical energy uses. Nuclear energy can possibly become a major source of usable power and energy only after several decades of effort in solving the major health problems, in plant development, and in building the enormous new facilities required. Our overall energy problem will be solved only through an immediate, vigorous, concerted effort on all energy fronts.

Mr. Rusler, a registered mechanical and electrical engineer in Minnesota, has degrees in engineering and mathematics from the University of Oklahoma. For 15 years he has served in research, project supervision, and staff engineering at Minneapolis-Honeywell on many types of research applications, and has had 16 years' experience in the design, development, and manufacture of geophysical oil surveying equipment.

lems, such as pollution of sea life or of underground water. If one projects this problem into the future when all of the World's conventional power plants, multiplied by a factor of 23 or more, are replaced by atomic plants then the enormity of the problem of waste disposal becomes apparent. Perhaps, on this scale, the problem may not be solvable.

Next, we should note that the atomic power plant is in its initial state of development. The first large plant in the U.S. has just been put into operation at Shippingport, Pa. Many types of plants will have to be tried before a standardized plant will be evolved. This may require years or even a decade or so to accomplish. Only then can widespread construction of atomic power plants be attempted. With this accomplishment, there will then be the tremendous task of building the hundreds of plants required just to supplant our conventional generating units. Obviously this task will require an additional decade or so to accomplish.

Now, if we attempt to build a generating capacity approaching the foregoing factor of 23 times the current normal capacity at this future time, then the enormity of the task becomes apparent. Also, we should remember that time is an important factor since depletion of our conventional fossil fuels will be a pressing problem by 1970-1980.

But let us consider atomic plant capacity only as a supplementary energy source, to be accomplished according to current estimates. Frances McCune[1], General Electric Co., predicts that in 1980 some 23 percent of our normal electric power will be generated by atomic plants. E. E. Burlingame[2], Arthur D. Little Co., puts the figure at 15 percent, while the Joint Committee on Atomic Energy[3] predicts 5 to 15 percent by 1975.

Based on present trends, the 23 percent estimate would represent a saving in fossil fuels of about 3 percent of the total consumption at that time, and the net energy contribution at the switchboards would be about 0.9 percent of the entire energy demand. But, by 1980, many of our fossil fuel reserves will have been exhausted or will be nearing depletion.

In short, if atomic electrical power is to make a major contribution to our overall energy requirement by 1980 of say 20 percent, then our plant construction effort must be some 20 to 25 times greater than that required by Mr. McCune's estimate.

Incidentally, P. C. Putnam[4], consultant to the U.S. Atomic Energy Commission, states that nuclear fuels "are not suitable for carrying much more than 10 to 20 percent of a total energy system, whatever its size, so long as its pattern is like ours today."

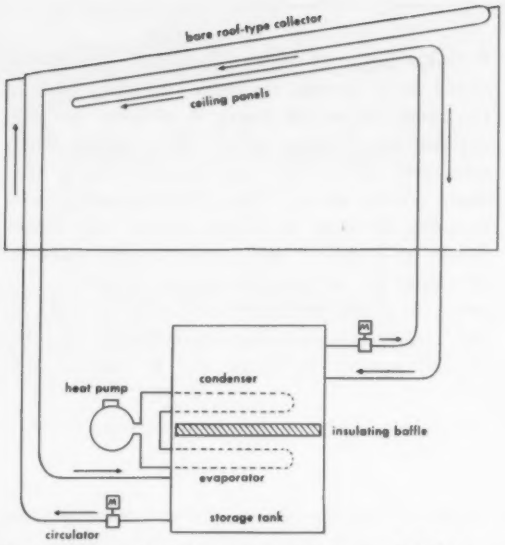
Nuclear Plants Have Big Material Requirements

We should further note that atomic power plants, as we know them today, require a disproportionate amount of basic materials as compared with steam plants. For instance, a report[5] on the Calder-Hall plant in England describes shields which are huge steel plates about 6 in. thick and graphite control rods which weigh more than 1000 tons. *This is only a nominal size of plant.*

Projected on a national scale, this large requirement for basic materials could place a heavy drain on our already overburdened natural resources. This point is emphasized by E. C. Furnas[6]. Moreover, the consumption of fossil fuels required to process these materials might prove to be serious and, in fact, there might not be enough of these fuels to make a rapid transition to the new power facilities. The impact of this situation is pointed up by Charles S. Scarlott[7], who states that some 50 times more energy is required to produce a ton of taconite concentrate than to mine a ton of iron ore.

Along the same line, Paul F. Genachte[8] states that the electrical power consumed to produce our present output of enriched uranium is enormous, being "about 10 percent of all the electricity produced in the nation." This naturally raises the question, namely: If all this uranium were burned in atomic power plants at 25 percent efficiency, what would be the net gain in electrical power over that consumed in its preparation?

At present, it appears that large installations will be required for the effective use of nuclear fission. This



SUN'S ENERGY is free for the taking. Only problem is saving it for a rainy day. Solar collector roof (left), at University of Arizona's Institute of Atmospheric Physics, is made of copper panels with integral parallel tubes. Water pumped through tubes is heated by sun and returned to storage tank (right), then pumped to interior ceiling panels

raises the problem of small installations and home heating. Of course, in the cities, the generation of electricity and central steam heating may be combined in one large plant to meet a part of this problem. But in small towns and rural areas, this problem will still exist.

Glenn L. Martin Aircraft Co. recently announced the development of a portable nulcear-electric plant capable of supplying the present day electric demand of a town of 2500 people and costing $2½ million. This appears to be a special applications device and not an immediate answer to the dispersed area energy problem.

Process heat is another area in which fission energy might make a sizeable contribution to our energy requirement. However, aside from a little talk, it appears that very little is being done about it in the way of actual development. Such developments and applications to specific uses will again probably require considerable time.

In view of the aforementioned, it appears that, at best, many decades will pass before nuclear fission will become a truly major source of power and energy, and even then its scope of application may be rather limited.

In considering nuclear fusion, we know that this process has been achieved in the hydrogen bomb. But we must face the fact that control of the process has not been demonstrated as feasible. Certainly the generation of temperatures of millions of degrees and the control of these temperatures seems fantastic.

The benefits to be derived from fusion, if it could be accomplished and controlled, are certainly intriguing, hence the large research effort toward this end. However, there seems to be a poverty of ideas as to how this can be accomplished. Richard F. Post[9] suggests several possible approaches to solving this problem, and then proceeds to show why these approaches are not feasible. He says that a successful approach must be both qualitatively operable and quantitatively feasible and that this combination has not yet been achieved.

Clearly, if control of nuclear fusion is obtained, then some completely new breakthrough of knowledge must be achieved. There is considerable optimism that this will occur, which is very good, but we should not be disarmed by it.

Although control of fusion for power purposes might be demonstrated next year as being technically feasible, on the other hand it might require several years or even several decades for this to be accomplished from an overall practical standpoint. And when it is, then all that was said about atomic power plants will probably apply to the practical development, construction, and utilization of fusion plants.

It therefore appears unsafe to count on a major energy contribution from fusion in the foreseeable future and particularly in time to avert the impending energy crisis. This conclusion is supported by Mr. Post: "That an early success in achieving a controlled fusion reaction would lead to economically competitive power in the near future is highly unlikely."

The Sun: An "Income" Energy Source

Let's turn our attention to the consideration of solar energy. The sun is truly our primary source of energy. Our food, our clothing, and all the other things that support life depend on it. Even our fossil fuels were derived from the sun during past geological ages. This energy is all around us, is free for the taking, and is available in large quantities. The solar energy falling on the continental U.S. is about 1500 times our present total energy consumption. Best of all, there is no practical limit to its source—it is an "income" energy.

Solar energy is *the* one major source of energy which would not require several decades of development before large energy contributions could be obtained. Its use does not involve such serious problems as control of a critical mass, or disposal of dangerous waste products, or operating health hazards. It does not require multi-million dollar installations, nor huge concentrations of basic materials, nor elaborate controls. Sufficient engineering and know-how, as well as simple processes, are already sufficiently available to make a major start at its utilization. The only elements lacking are an appreciation of the urgency of the energy situation and a determination to get started.

Of course, there are some problems connected with the utilization of solar energy. Because of its low concentration, the principal problem is quantitative in nature. Theoretically, the solar radiation falling on a normal surface of 1 sq meter amounts to 1.35 kw. Due to losses in the atmosphere and other factors, the average insulation value on a sunny day in the lower latitudes is about 0.8 kw per sq meter or 75 watts per sq ft.

Hence our principal problem involves the collection of energy from comparatively large areas. Because sunshine is intermittent, due to day and night and cloudy weather, the second major problem is storage of the energy collected. The final important problem is concerned with various transformations of solar energy into other forms which are more usable or easier to handle.

Solar Heating Can Be Biggest Fossil Fuel Saver

What are the possible applications of solar energy to the four categories of energy usage mentioned earlier; i.e., space heating, industrial process, transportation, and electric power generation? Since space heating is the largest, it offers the greatest opportunity for conservation of our fossil fuels. This is fortunate because the requirement of space heating for low grade heat ideally matches the low grade heat derived from the simplest and most efficient solar energy transducers.

Of the 31 percent of our energy used for space heating, some 20 percent goes to heating of homes. Here, therefore, is an area for the immediate and practical application of solar energy, using conventional methods. It is interesting to note, in this connection, that the solar energy falling on the average house in many areas is sufficient for most of its heating needs.

In view of the suitability of solar energy for home heating, there are at the present time several experimental houses being built to help in studying the problem involved.

Water heating and water distillation are also very promising areas for the application of solar energy. The water heater can very easily be integrated into the house heating system, while industrial heating of water is quite practical.

Solar engines and power plants on a small to medium scale are quite feasible. This is very important since it could provide power or electricity in many out-of-the-way places. There would be no requirement for transportation of fuel or electrical transmission lines because the energy is already there. A 1 hp solar engine could pump more water than a man with a team of oxen, and thus could release him for other agricultural duties. Such an engine could be of the low pressure steam or hot air type.

It's Time to Cut Down; Get Busy

If this appraisal of our energy situation is anywhere near correct, then the question may rightly be raised: What can be done to avoid the consequences set forth? There are three possible steps or answers:

First, we could and should materially and immediately enlarge our efforts toward the development of other major sources of energy. Solar energy is the most susceptible to major exploitation in the near future, while developments of fission and fusion energies to positions of major contributions will probably require several decades. In order to "buy" the time required for these developments, steps two and three, which involve rigorous conservation of our fossil fuels, could be employed.

Step two involves efficient use of fossil fuels without waste. This would tend to reduce consumption and both the base and the rate of the exponential demand function would be lower.

For the third step, the U.S., as a national policy, could systematically stock pile petroleum on a large scale. This could be accomplished by immediately importing large enough quantities of oil to meet our consumption needs. Thus, our present underground reserves would be kept intact as long as possible. We could even pump imported oil down into depleted oil fields, which have served as good storage for millions of years. It is recognized that there are many domestic and other problems involved in this step, but the urgency of the situation may warrant its adoption.

It has been the purpose of this article to impress the reader with the seriousness of the energy situation in the United States. It is hoped that he will react positively to it and will not dismiss this discussion with the potentially dangerous thought: Why worry? Something will turn up to bail us out of our predicament. ⧺

[1] *Atomic Energy and Electric Power*, by Raymond Moley, Newsweek, June 27, 1957.

[2] *Where'll Tomorrow's Energy Come From?—Nuclear Energy's Price Tag*, by E. E. Burlingame, The Oil and Gas Journal, February 25, 1957.

[3] *Peaceful Uses of Atomic Energy*, 1956 report by the Joint Committee on Atomic Energy.

[4] *Energy in the Future*, P. C. Putnam, consultant to the Atomic Energy Commission, D. Van Nostrand Co.

[5] Nucleonics, September 1955.

[6] *Energy Sources of the Future*, by E. C. Furnas, Industrial and Engineering Chemistry, December 1954.

[7] *Utilization of Solar Energy*, by Charles S. Scarlott, Stanford Research Publication, 1955.

[8] *Moving Ahead with the Atom*, by Paul F. Genachte, The Chase Manhattan Bank, 1957.

[9] *Controlled Fusion Reaction*, by Richard F. Post, Review of Modern Physics, July 1956.

NAVY'S LAKEHURST, N. J., jet aircraft launching facilities are served by power plant which can supply 152,000 lb per hr of 1200 psig steam, three-cell cooling tower capable of delivering 11,000 gpm of cooling water. Steam catapult and gas-air catapult are shown in background. Photograph was taken during construction and shows contractor's field office and warehouse

High Pressure Steam and Air Piping Serves Experimental Jet Catapults

. . . to deliver 1200 psig steam, 1500 psig compressed air

• The Navy's new prototype jet aircraft launching installation at Lakehurst, N.J., features high pressure steam and air piping facilities which serve two types of experimental catapults. A central boiler plant, housing four large packaged steam generators, is set up to deliver steam for two sets of operating conditions: For a steam catapult the plant supplies 1200 psig steam at 750 F to four accumulators. For a new gas-air catapult it delivers steam at 540 psig and 860 F to a turbine driven compressor plant which supplies 1500 psig compressed air for mixing with aviation fuel. Automatic control valves in the boiler house afford the flexibility to meet various demands. Underground piping connects the boiler house with the steam accumulator pit. Due to the potential danger when using steam at these high pressures, all welds were radiographed. Heat generated during air compression for the gas-air catapult is removed by a cooling tower.

BY MILTON SIMKIN
Vice President
Charles Simkin & Sons, Inc.
Engineering Contractors

A CATAPULT that will launch heavier jet aircraft skyward at the rate of one every 10 seconds is the goal of the U. S. Navy's new prototype catapult installation at Lakehurst, N. J.

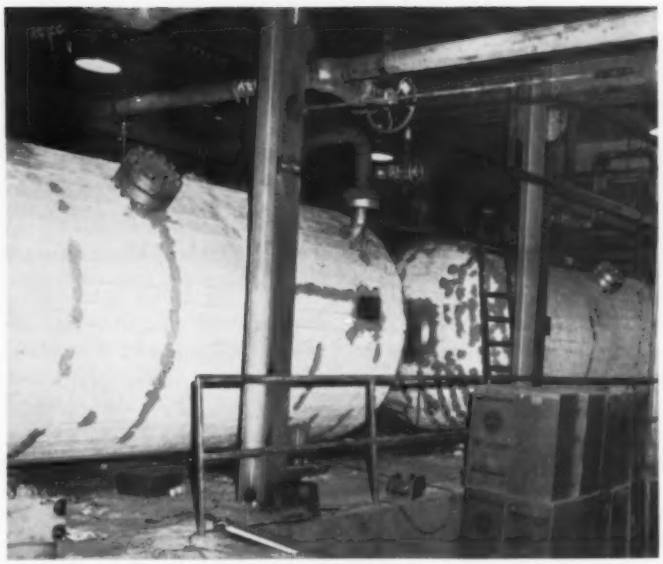
The facility includes two new types of catapults which the Navy hopes will meet this national defense need. One utilizes 1200 psig steam and is, in effect, an increased power version of the inadequate 600 psig steam catapults currently in use. The other is entirely new in principle, the combustion charge being made by fusing JP-4 aviation gasoline with oxygen.

Two Sets of Conditions

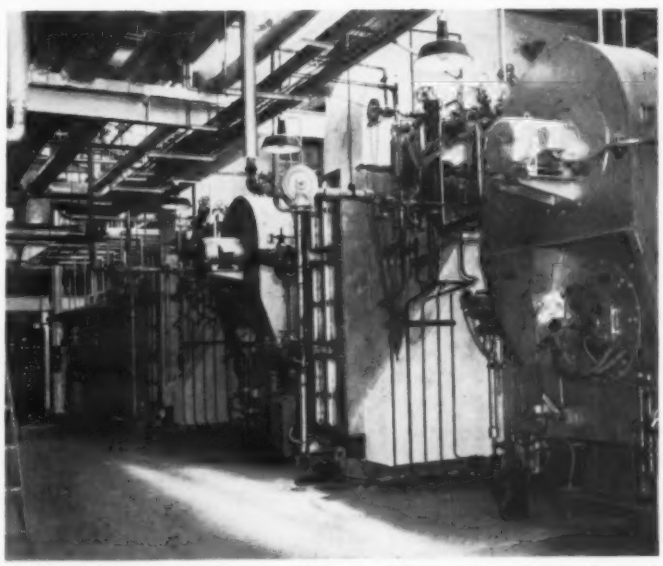
The steam power plant embodies four packaged steam generators, each rated 38,000 lb per hr at an operating pressure of 1200 psig. These boilers operate under two sets of conditions:

For the steam catapult they will deliver 1200 psig steam at 750 F superheat to four steam accumulators which are installed in the underground accumulator pit about 100 ft from the boiler house. These accumulators, constructed of 3 in. alloy steel and 8 ft in diameter × 26 ft long, will store steam for operation of the steam catapult. The boilers are protected against the extremely rapid accumulator operating cycle by a back pressure control system utilizing a single 6 in. air operated valve capable of stroking in less than 1 sec.

For the gas-air catapult, the boilers



STEAM ACCUMULATORS are installed underground about 100 ft from boiler house and provide steam storage for operation of steam catapult. Photograph was taken during installation



BOILER HOUSE contains four packaged steam generators, each rated 38,000 lb per hr at 1200 psig, one 120 psig auxiliary unit for heating and control services

will deliver 540 psig steam at 860 F superheat to the turbine driven compressor plant. This will then discharge 1500 psig compressed air which, when mixed with JP-4 aviation gasoline, will deliver the thrust to the gas-air catapult. This principle of catapult power is entirely new for this application.

A series of automatic control valves in the boiler house makes it very simple to bypass the compressor plant when the steam catapult is being used. Steam at 540 psig must still be generated to operate the turbine driven boilerfeed pumps.

Condition Boiler Feedwater

The 250 × 75 ft boiler house also includes a complete water demineralization system. Water supplied by a 100 gpm, 60 ft deep well pump discharges into a 250,000 gal field erected raw water storage tank. A bypass is taken from the well pump discharge to supply the extensive outside fire hydrant system.

From the raw water storage tank, the water is pumped through the demineralizers and then either to the treated water storage tank or directly to the boilerfeed pumps which discharge the water at 1300 psig. On the discharge side of the pumps, chemicals are introduced to prevent corrosion in the boilers.

Auxiliary steam for comfort heating and control services is generated by a fifth boiler which operates at 120 psig saturated steam.

One end of the power house has a separately heated and air conditioned bunk room, office, galley, toilet room, calibration room, camera repair room, dark room, studio, storeroom, and lobby.

Outside is a 4540 bbl field-erected fuel oil tank for the storage of the No. 6 fuel oil used to fire the boilers. The JP-4 gasoline is stored in four 20,000 gal underground storage tanks, each having its own 225 gpm pump.

Piping Services Underground

From the boiler house, a tunnel carries the 8 in., 1200 psig steam; 8 in., 1500 psig air; 3 in., 120 psig steam; 4 in. service water; and 1 in. service air to the underground accumulator pit.

Adjacent to this pit is an observation and instrumentation room for Naval personnel when a catapult is fired. From the accumulator pit there is access to either the gas-air catapult room or steam catapult room, both of which are also underground. In addition to the catapult firing mechanisms, each catapult room contains a 3000 psig auxiliary air compressor and two 100 psig auxiliary air compressors.

The catapults themselves are each 280 ft long. This is the distance the jet aircraft are pulled by the catapult shuttle cock, their being airborne at the end of this run. The shuttle cock is arrested at the end of its run by a water-brake pit.

All Pipe Welds Radiographed

Potential danger exists when using steam at these operating conditions. So it was necessary to radiograph all pipe welds subjected to either 540 psig or 1200 psig operating conditions. All welds requiring preheat and stress relieving were performed in accordance with the ASA code. Lines subjected to temperatures in excess of 750 F are of carbon moly.

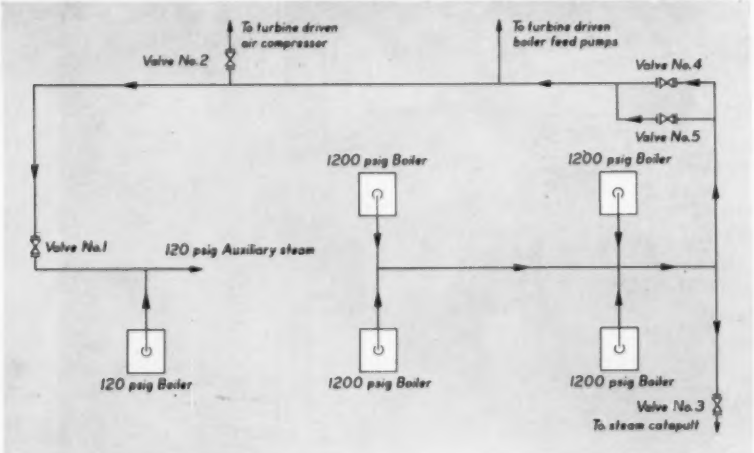
The tremendous amount of heat generated during the compressing of air to operate the gas-air catapult is removed by an outside, field-erected, three-cell cooling tower, and a pump capable of delivering 11,000 gpm of cooling water to the four intercoolers and one condenser.

To remove the 192 million Btu per hr heat load for which the cooling tower is designed, three 20 ft diam stainless steel fans circulate almost 1½ million cfm through it.

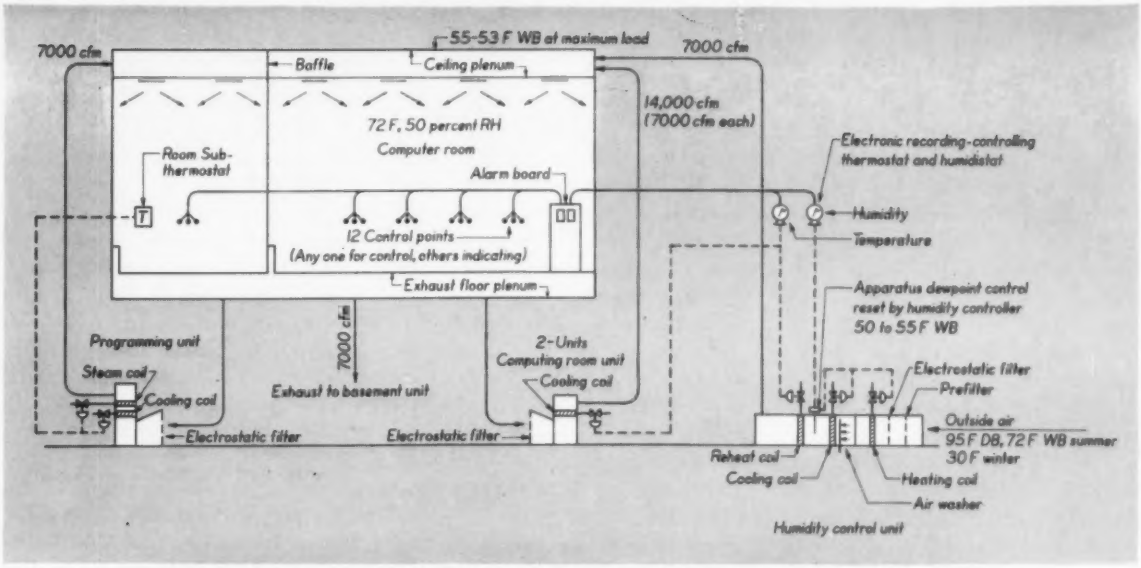
A mile down the runway from the catapults is the arresting gear site, a building 120 × 100 ft. This structure is completely underground, except for an air conditioned observation tower off to one side.

Four aircraft arresting engines are housed in this pit. These operate on a high pressure hydraulic and pneumatic system. The only equipment above ground are the cables that catch the tail hook of the landing aircraft and the numerous large sheaves which guide the cables. The pneumatic system is operated by a 2500 psig air compressor and a 100 psig auxiliary air compressor.

Charles Simkin & Sons, Inc. was the mechanical (heating, piping, and air conditioning) contractor for the installation. ⊣



AUTOMATIC CONTROL valves in boiler house afford flexibility to meet various demands. Valve No. 1 bleeds excess steam from high pressure systems to 120 psig system. During steam catapult operation, motorized valve No. 2 is closed; during gas-air catapult operation, motorized valve No. 3 is closed. When pressure rises to 1200 psig, valve No. 4 closes and steam flows only through valve No. 5 to operate boiler-feed pumps



AIR FLOW and control schematic of air conditioning system serving Bank of America EDPM computer room shown here. Steam and chilled water coils are supplied from central system

Unique Built-up System Serves Exacting Temperature, Humidity Demands

. . . of finicky electronic computers

● A laboring electronic computer generates a lot of heat—so much so that facilities must be provided to remove it to insure against breakdown. Also, relative humidities must be maintained at exacting levels to prevent shrinking or stretching of recording tape that would affect the accuracy of the data computed. One such installation is in the new Bank of America building in Los Angeles. Temperature and humidity conditions are kept at 72 F and 50 percent RH by a unique central built-up year 'round air conditioning system.

Mr. Norcross, a mechanical engineering graduate of the University of Southern California, is a registered professional engineer in the State of California and a member of the American Society of Heating and Air-Conditioning Engineers. His long experience includes seven years as chief mechanical engineer for a Los Angeles engineering firm. He is now the principal of the Hinkston and Norcross firm, formed in 1951.

BY IVAN F. NORCROSS
Hinkston and Norcross, Inc.
Consulting Engineers

THE NEW Bank of America building, Los Angeles, houses the latest in electronic machines to process and record the tremendous volume of data required in the banking business. These facilities include four floors of card punch machines and one floor for EDPM computers and tape recorders. (In addition, one story has been set aside for the future installation of ERMA units.)

Each typical floor with card punch machines is comfort air conditioned, served by a central steam and chilled water system. While these units can

get along with conventional air conditioning, the EDPM computers must be enclosed in rooms which are air conditioned to an exacting degree.

The problems with the EDPM units are heat and humidity. These units contain many high heat producing vacuum tubes. This heat must be carried away, lest it damage the units' delicate mechanisms. Strict humidity control is necessary to prevent changes in the length of the recording tape that would upset the accuracy of the printing machine.

Each EDPM draws in room air near floor level and discharges heated air—as high as 120 F—out the top. While the internal heat gain of the room ranges from high during the day to low at night, no change in relative humidity can be permitted at any time.

Heat distribution within the room varies from 330 Btu per hr per sq ft at the power supply EDPM unit to 20 Btu per hr per sq ft at the console.

The various pieces of computer equipment can be shifted within the space and, as new designs occur, they may be replaced with equipment having different heat gain properties.

What Were Design Criteria?

Criteria for the design of the air conditioning system were as follows: Design conditions in the Los Angeles area are 95 F dry bulb and 72 F wet bulb in summer, and 30 F in winter. Computer operation demands conditions of 72 F ($\pm 2\frac{1}{2}$ F deg) and 50 percent relative humidity (± 5 percent RH). Sensible heat loads were anticipated to be 75 Btu per hr per sq ft during the day and 8 Btu per hr per sq ft at night. Allowance was made for latent loads created by occupancy of 15 persons in daytime and one person during the night.

Supply air is delivered to the room at 28,000 and 7000 cfm, respectively, during the day and night. When considering the humidity control of 28,000 cfm of supply air to a room containing only 15 people, it became apparent that ordinary controls may have difficulty in sensing and controlling within the limits of 0.45 gr of moisture per lb of air circulated. This system is designed to control the humidity of one-fourth of the circulated air, thereby affording four times the sensitivity of control.

Four air handling units each supply 7000 cfm of air into a common plenum. One of the four, which supplies outside air, provides humidity control. This unit operates day and night. The other three air handling units provide sensible cooling, and are used only when the EDPM machines are operating.

All air handling units are equipped with electrostatic filters and water cooling coils. One unit has an emergency humidifier; another has an outside air supply unit, a preheat coil, cooling coils, water sprays, and a reheat coil.

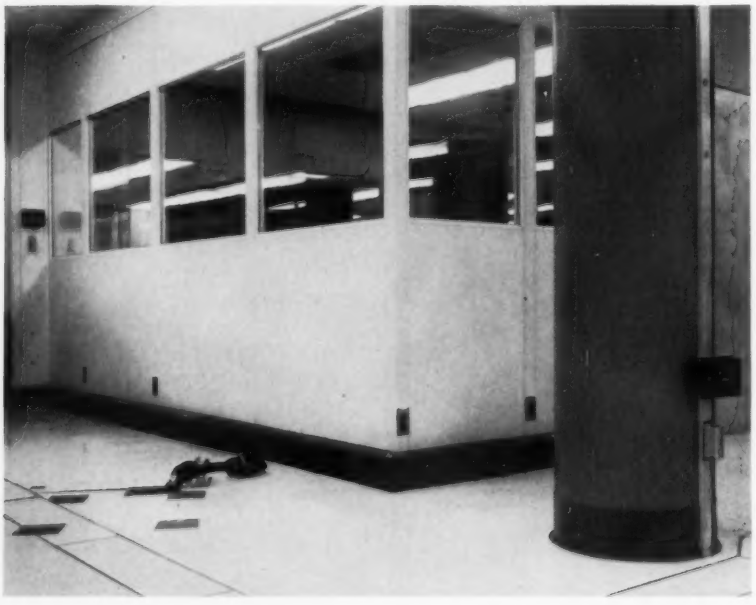
The basic control system consists of a room humidistat, which sets the apparatus dewpoint of the outside air handling unit, and a room thermostat, which controls the leaving air temperature of all units. Standby protection is provided for all control mechanisms.

Admit Air Via Ceiling Plenum

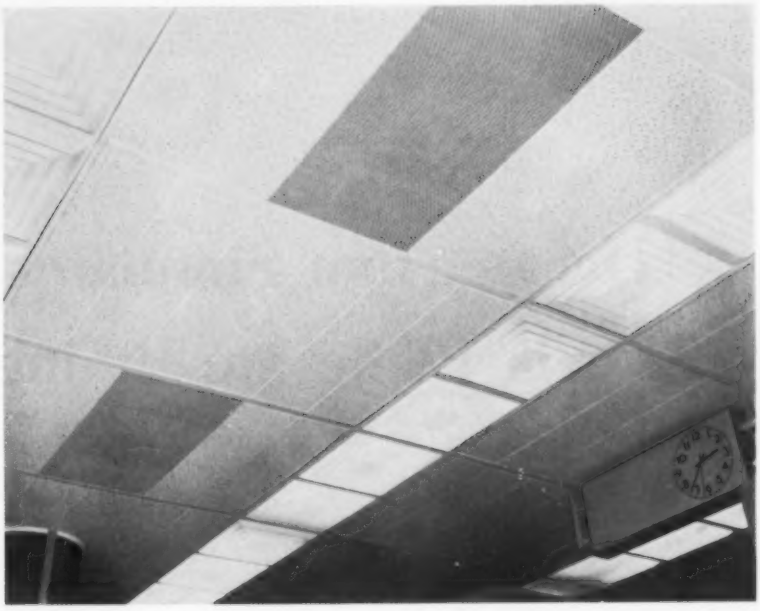
A ceiling plenum was selected as a means of varying the amounts of cooled air. The ceiling, hung from tee iron framework, consists of cane fiber panels that are interchangeable with lights and diffusers.

Supply air is admitted to the room at 54 to 56 F. Heated air ranging from 90 to 120 F discharges from the tops of the EDPM units and mixes violently near the ceiling with the cooled supply air. At the same time, there is but 2 F deg temperature differential between the 5 ft level and the floor throughout the room, with no drafts.

Cooling needs are met by two 225 ton centrifugal compressors, each



RETURN AIR is exhausted through continuous baseboard grille. Note plug-in receptacle for IBM machine and cable trench in floor to permit computers to be moved



CEILING DIFFUSERS are perforated metal and are interchangeable with adjacent ceiling panels. Entire area above ceiling is supply air plenum. Arrangement provides complete flexibility of system if computers are moved

with its own cooling tower and circulating pumps. Water temperature is kept at 45 F the year 'round.

Two 5 psi boilers furnish heat for the building, domestic hot water, and steam for the emergency humidifier in the air handling system. Heating is required for perimeter offices only, the greater portion of the building requiring cooling all winter.

12 Control Sensing Points

EDPM room controls consist of an electronic temperature recorder-controller and an electronic humidity recorder-controller. There are 12 selective points of sensing within the space. These instruments send the control signal to the pneumatic control system, using pilot operated steam and chilled water valves.

A warning system in the equipment room tells the operator when the temperature or humidity in the computer room is not at the control point. These alarms are part of the electronic control devices.

An emergency control system, operated by separate pneumatic controls, will respond to temperature and humidity variations, activating either a steam humidifier or auxiliary cooling coils. These controls are entirely separate from the electronic devices in the room.

Controls for the chilled water and boilers are complete and independent for each machine. If a mechanical failure occurs in one system, the other will automatically pick up the load. This thinking was extended to the point of supplying two air compressors for control air, two condensate pumps, auxiliary water supply to the spray humidifier, and other standby safeguards against breakdown.

The consulting engineers for the system were Hinkston and Norcross, Inc. The architect was Continental Service Co. Pierce Engineering Co. was the mechanical (heating, piping, and air conditioning) contractor. ⫩

Prove Negative Ions Important Health Factor

SCIENTISTS have found that when people with hay fever, asthma, and sinusitus are subjected to air having negative ions, relief has been experienced, according to Dr. Rudolph A. Nagy, manager of ultraviolet development, Westinghouse Electric Corp. He also reported recently that wounds have been found to heal more rapidly, and arthritis and rheumatism are reduced.

Dr. Nagy reported that a survey of findings by scientific researchers around the world has indicated that when the air is charged with positive ions, there is a noticeable increase in discomfort. This may take the form of fatigue, dizziness, headaches, asthma, and sinusitus. It has also been found to adversely affect rheumatism and arthritis, to cause mental depression, and to slow healing.

Dr. Nagy warned that it was far too early to say that by producing a few negative ions that illnesses or mental depression could be eliminated. However, there is sufficient evidence at present to indicate beyond reasonable doubt that the ions, which are always present in our atmosphere, do play an important role in our living. ⫩

Oceanarium Simulates the Briny Via Elaborate Piping System

. . . so denizens of the deep can frolic in tempered sea water while tourists look on

BY J. MARX AYRES
Consulting Mechanical Engineer

A BIG attraction to tourists of southern California these days is Marineland of the Pacific. Here, visitors may observe the only whale in captivity, trained porpoises, vicious sharks, giant bat rays, exotic tropical fish, and other creatures of the sea in their natural surroundings.

Here also is a very elaborate piping system and mechanical plant which keeps these fish and mammals supplied with clean sea water which is properly filtered, heated or cooled, and chemically treated as required by each display.

Located about 30 miles from Los Angeles on the tip of Palos Verdes Peninsula, the 65 acre site is 100 ft above sea level and is surrounded on three sides by rocky cliffs. In addition to the main oceanarium and smaller outdoor tanks, the site includes a deluxe restaurant and bar, a motel, a gift shop, a snack bar, and maintenance and service buildings. The first increment cost upwards of $3 million. Since then, several additions have been completed, including a small outdoor pool for harbor seals and a new sea arena consisting of a tank and grandstand for surface viewing of the seals and porpoises during the performances of their shows.

The oceanarium consists essentially of two motor driven deep well pumps located at sea level. These supply sea water to two banks of sand filters at the top of the hill. Water from these filters is then pumped by two horizontal split case pumps to each of two large gunited steel tanks with visitors' viewing windows.

Part of the sea water is supplied to a storage tank where it is then fed by gravity to other smaller aquarium tanks, laboratory, octopus tanks, etc. Water from all tanks then flows by gravity either back to the filters or to the sea.

Need Raw Sea Water Supply

The success of a project like this depends almost entirely on a plentiful source of raw sea water. Water collection systems are special problems

● Sea water—filtered and heated or cooled according to the marine display—is supplied to Marineland of the Pacific by an elaborate piping system and mechanical plant. Two motor driven deep well pumps located at sea level deliver sea water to two banks of sand filters at the oceanarium, 100 ft above sea level. Water is then pumped by two horizontal split case pumps to two large visitors' viewing tanks and to a storage tank which, by gravity, feeds smaller tanks. Raw sea water is obtained by an underwater infiltration collection system.

Mr. Ayres, now a consulting mechanical engineer, was chief mechanical engineer for Pereira & Luckman at the time that firm designed and supervised the Marineland of the Pacific project. Later, he was retained as consultant to Marineland.

AERIAL VIEW shows new sea arena at left, main oceanarium in center right. Two tanks in main oceanarium have total capacity of more than 1 million gal of water

in themselves. Off-shore pumping plants are often damaged by wave action and must be maintained almost continuously. Also, water pollution by storm action and invading marine growth or plant growth are constant enigmas. Consequently, in designing this system every effort was made to establish an underwater sea water infiltration collection system instead of an off-shore pumping plant.

Early core tests on the site indicated that vertical sea water collection systems would be impossible at this site due to the heavy rock encountered and very small yield. A small shale beach near the pier about 3500 ft from the site of the main oceanarium was finally selected for a horizontal subsurface infiltration gallery. It consists of a perforated, 20 in. diam, 200 psi, cement asbestos pipe set at the water line in an open trench about 10 ft below sea level. The pipe is surrounded by graded gravel, protected from downward silting about 6 ft above the pipe with several layers of asphalt saturated felt, and then finished off with natural beach gravel backfill.

The pipe is about 340 ft long and is installed to pitch toward a central manhole. It is then carried to a pump sump in a 24 in. concrete pipe. All joints in the cement asbestos pipe are rubber ring type, made up in the trench under water.

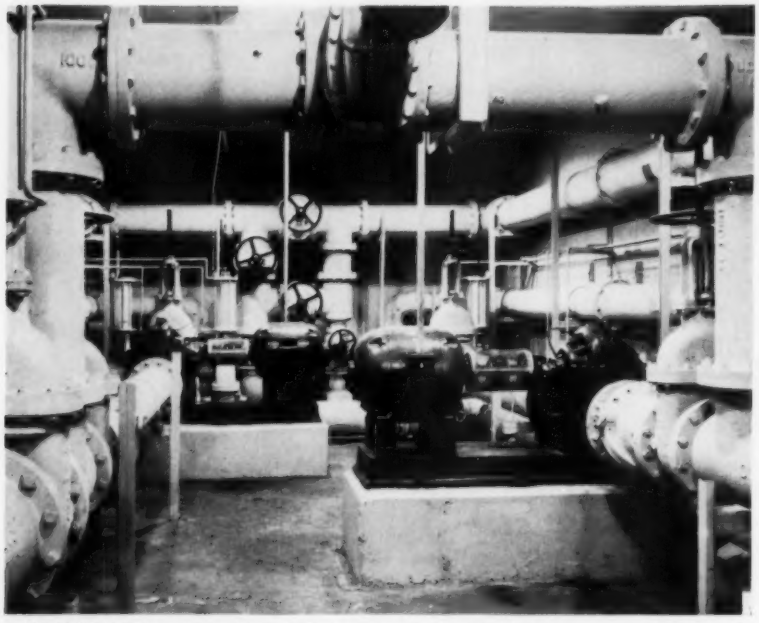
Modify Collection System

During construction, unknown underground rock outcroppings were met which made it necessary to modify the collection system to extend most of the gallery in one direction. Even then, some rock was encountered and one end of the collection pipe had to be placed at higher elevations than desired. The flow of sea water to the gallery depends on the difference in elevation between the water in the pump sump and the sea water level. Consequently, the yields or flow to the pump sump varies with the tides. Present operation requires throttling the supply pumps at the few very lowest tides to prevent cavitation.

The two sea water supply pumps are enclosed in a beach pump house located as close as possible to the cliffs. In establishing the floor level of the pump house, storm conditions at the site and uprush of the waves along the rocky beach were carefully analyzed to assure a dry pump room at all times.

The two 100 hp motor driven pumps were selected to deliver 2000 gpm at 167 ft total head each. One pump serves as standby in case of power outage and is fitted with a right angle gear drive and 116 brake hp gasoline engine. A 150 gal gasoline storage tank is set in the ground behind the pump house with a dry storage tank on the engine. A permanent "A" frame is mounted on the pump house roof so pumps can be pulled for maintenance.

The pump sump is 10 ft in diameter and 28 ft below the pump house floor. It was built by setting a section of reinforced concrete pipe on the beach, excavating the center, and al-



PIPE GALLERY between filter beds houses two 40 hp, 3500 gpm pumps that supply large oval and circular tanks

lowing the pipe to settle due to its own weight. When all sections were in and cemented, the bottom was provided with a concrete plug. The sump is fitted with a brass ladder for access, and a 6 in. open-ended cement asbestos pipe to contain a ball float for transmitting the water level up the hill to the central control station in the filter house.

Each pump is a two-stage deep well turbine bowl assembly made up with cast iron case and impeller, monel shaft, and self-lubricated rubber bearings in stainless steel bearing shells. Pump columns are flanged steel, coated with neoprene rubber made up with stainless steel bolts. Discharge heads are cast iron and motors are vertical hollow shaft, shielded, dripproof induction type. Pump bowls are mounted within 12 in. of the pump sump floor to assure maximum yield from the collection system.

The supply line from the sea water pumps to the oceanarium is 100 psi, 12 in. cement asbestos pipe and, in general, follows the road from a 250 ft long pier up the hill to the oceanarium. A stainless steel orifice plate in a concrete vault downstream from the pumps gives a continuous record of flow rates. Data is transmitted electrically to the central control station in the filter house.

This method of collecting sea water is very effective. The beach sand and rock act as a filtration plant and the tidal action offers continual backwashing of the gravel around the collecting pipes. Wave action on the surf proves to be an excellent aerator of the sea water and very low bacteria count is found in the collected water. The underwater collection system has been in operation now for four years without any maintenance at all and should give successful service for several decades.

A "Man-Made" Ocean

The oceanarium contains the two largest salt water tanks in the world. One is circular and the other oval. Together, these tanks hold more than 1 million gal of water. Three continuous bands of large viewing windows, 358 in all, surround both tanks at three different levels below the water surface. Access to various viewing levels is by means of gently sloping ramps.

The circular tank is 80 ft in diameter and 22 ft deep and contains 640,000 gal of sea water. The water temperature in this tank is allowed to vary with the seasons and is designed for the display of local Pacific Ocean fish and mammals. The fourth or top level contains a 1500 seat amphitheater for surface viewing of porpoises and whales.

The oval tank is 100 ft long, 50 ft wide and 22 ft deep. It contains 550,000 gal of sea water and is designed for the display of tropical species requiring warmed water. The bottom of this tank is lined with rocks, remnants of sunken vessels, and coral reefs to add realism to the "man-made" ocean.

Model Tests Aid in Design

One-twelfth scale model tests were conducted on these tanks to assure proper location of water intake and drain connections and shape of the tank bottoms. The basic design incorporated rotational action of the water to assist in self-cleaning of the tank and to exercise the fish to show them off to their best advantage. The tests indicated that this could be achieved by introducing the water at the tank bottoms with four jets set along a line through the center of the tank and removing the water from the tank through a single center drain.

The basic design also incorporated tank bottoms stepped inward about 10 ft at the perimeter to permit closer viewing of the fish near the bottom and to create better vertical distribution of the fish for display. These tests established the final design flow rate at 3500 gpm to each tank.

The two large tanks are serviced from the top level. A shallow tank, or holding flume, with gates is located on this level between the two to receive incoming aquatic specimens for examination before sending them into the tanks. Divers' stations are also provided for each tank with clean, dry compressed air, hose, etc. These stations are used quite frequently for underwater feedings, window washing, and other maintenance work.

More details of this installation will be presented in an early issue. ⧺

Winning the Air Conditioning Odor Fight

Round 2:

Estimate the Enemy's Strength

BY ALBERT B. HUBBARD

HOW CAN odors be measured? The answer to this question forms the second link in a chain of knowledge needed to cure odor-ailing air conditioning systems.

Because odorant quantity leads to a complaint by the owner of an air conditioning system and because quantity helps find the odor source (as will be explained in later articles) odor measurement becomes basic to all odor problems. The qualitative principles of odors were discussed in the January article. With this as background, the quantitative aspect is worth a once over lightly.

From a seven year literature search, I have concluded that prospects of instrumental measurement are very dim. At this point swivel chair riders defend their foam-rubber supported positions by stating that odor abatement is not worth working on until someone invents that simple instrument.

Actually, one instrument, the human nose, was invented ages ago and can be calibrated with a little practice. It is extraordinarily sensitive and gives answers in exactly appropriate dimensions. Barring certain rare organic abnormalities, anyone can be trained to smell quantitatively. As a matter of fact, self-training is pretty effective.

The main effort needed in developing a calibrated nose is psychological: built-in inhibitions and repressions must be overcome, and mental awareness, alertness, and discrimination must be acquired. You are inclined to feel your associates are thinking: "He likes those disgusting odors!" While there are some tricks of the trade, they don't include giving up smoking, abstaining from all but bland foods, and other departures from normal living—as would be prophesied from a swivel chair.

The first trick in free-hand smelling is to adopt a scale. A novice's goes like this: (1) barely perceptible; (2) moderate; (3) strong; (4) very strong; (5) overpowering.

Keep firmly in mind that this is a subjective measure of intensity not to be tempered by any opinions regarding offensiveness.

In adopting this scale, or one of your own, think of the steps as equally spaced. Each tone in music seems to the ear to be equally spaced from the preceding one; yet the actual frequency intervals form a constant *ratio*

• This series on the air conditioning odor problem started with the nose last month and continues with that superb instrument of odor detection here. Because, not only can the nose immediately sense a disagreeable aroma (qualitative detection) as discussed in Round 1 in January, it can also be trained to gage the strength of any smell—good or bad—according to an exacting scale (quantitative detection). Various lab techniques involving dilution and mixing of odor samples with certain amounts of odorless air are used successfully to assist this vital organ in making its calculations. But these are only aids. The real proof is in the smelling.

Mr. Hubbard, for several years a member of the American Society of Heating and Air-Conditioning Engineers Technical Advisory Committee on Odors and its chairman during 1956 and 1957, was long associated with General Electric Co.'s air conditioning department and has had considerable experience in the design and installation of air conditioning systems.

rather than a constant *difference*. Here, too, the physical concentration of odorant is a constant multiple in each interval.

As discrimination develops, you can divide the scale into more steps, supplying your own appropriate adjectives for the additional ones. The limit on subdivision will be 10 steps. If you try finer divisions, you will discover that you just don't have that kind of nose. Also with practice, you can begin to distinguish some separate components in odor blends and assign intensities to each.

Dilute to Smell Better

A useful technique in odor measurement is based on diluting the sample. Using a source of odorless air and a method of mixing it in easily variable proportions with the odor sample, adjust the mixture until you can barely recognize the odor. The result, expressed as the ratio of mixture volume to sample volume, is called the "number of thresholds." The nose is actually operating at its most reproducible point. While it is true that one observer's threshold may differ from another's, and that a given observer may vary due to physical condition, there are practical ways to calibrate and standardize.[1]

Number of thresholds has a useful meaning. Suppose the result were 10 thresholds. The most direct implication is that 1 cu ft of odorous air can taint 10 cu ft of air to a recognizable odor level.

Dilution measurement schemes divide into two broad classes, according to the actual hardware involved. The choice depends on the odor sample: how much, how strong, and in what form.

For powerful odors in small amounts, the static pressure system works best. A small glass mixing chamber, a source of clean, odorless air, perhaps a vacuum pump, glass tubing, and cocks are required. Manipulate the mixing chamber pressure so that first it is filled with clean air to a certain absolute pressure, P_C. Admit a trial amount of odorous air to bring the pressure to $P_C + P_o$. Release the mixing chamber air in a puff which can be sniffed. If you detect no odor, make more trials until threshold is reached or bracketed. The number of thresholds is $(P_C + P_o)/P_o$, where P_o is the partial pressure of odorant producing threshold sensation.

Actual mechanics and techniques used in static pressure dilution measurements are subject to countless variations. The methods and apparatus have been standardized only in specialized applications, such as the odorizing of illuminating gas where warning agents are specified in dilution terms.

Ordinarily, air conditioning odor investigators cannot use this small scale technique. Taking a bottle of air from the odor complaint scene to the laboratory is not likely to be a rewarding approach. Normally space odors in the objectionable range are only a few thresholds.

However, if a liquid or solid material on the premises is an odor source, it may be profitable to put a measured amount in the mixing chamber and run tests to determine how much air is needed to dilute it to the threshold. The result can be translated into ventilation requirements or show that a ventilation cure is impossible and that other corrective measures are required.

More Uses for Flowing System

The odor sleuth will find greater use for the flowing (or continuous) mixing system. Basic machinery needed is a fan with two suction ducts, each equipped with a suitable damper and flow rate indicator. You sniff the mixture at the fan discharge in a face sized stream and adjust proportions until *recognition* is just possible. This means recognition of any component of a blend. For instance, in checking kitchen air, you are looking for just recognizable aromas of "food," "grease," "garbage," "onion," "hamburger," etc.

Of many possible uses for such a mixer, let's consider one: Ventilation air from a certain location is a possible diluter of an objectionable odor at the discharge of the air conditioning system. Set up the mixer to blend sample flows from the proposed outdoor air source and the offending discharge. Adjust to the threshold and note the proportions. This ventilation test is inexpensive compared to the installation of an outside air duct.

Another dilution technique can be used to rate surfaces which are inherently odorous or suspected of harboring other odors. In the latter case, rating would involve standardized exposure to an odorant, such as tobacco smoke[2].

Suppose 1 sq ft of the thus exposed surface were placed in a glass vessel with an adjustable supply of odorless air. If you regulate the air flow until you can just recognize the odor in the leaving air stream, you have an immediately useful result. If the flow were 2 cfm, you would know that 150 sq ft of that surface in a room would require 300 cfm of ventilation air to keep its odor contribution down to the threshold.

A trade trick is used in surveying for surface odors: Smell the cardboard back of a writing pad. The odor seems insignificant. Now breathe on it with your mouth close to the surface and immediately sniff that spot. A considerable puff of odor will be noticeable. Moisture which condenses and then rapidly evaporates dislodges odors that otherwise go off too slowly to be smelled.

In other words, smell it free-hand or dilute it to recognition. These techniques are, at present, the only workable ones for odor measurement.

At this point we know a little about both the qualitative and quantitative aspects of odors. The next article, to appear in an early issue, will go into their physical properties. ⧺

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[1]*The Bacteria and Odor Control Problem in Occupied Spaces*, by R. L. Kuehner. Heating, Piping & Air Conditioning, December 1952, pp. 113-119.

[2]*Study and Evaluation of the Odor Properties of Surfaces*, by N. Deininger and F. Sullivan. Annals of the New York Academy of Sciences, Vol. 58, Art. 2, pp. 215-224, March 24, 1954.

How Much Heat to Temper Ventilation Air?

BY F. CAPLAN
Design Engineer
Kaiser Engineers
Div. of Henry J. Kaiser Co.

HOW MUCH HEAT is needed to temper ventilation air from the outdoors at zero F up to 60 F? If you know the quantity of air being introduced, this can be calculated very simply using the following formula:

$$Q = 0.24 \times \rho \times \text{cfh} \times \Delta \quad \text{.....[1]}$$

where:

Q = heat required, Btu per hr
0.24 = specific heat of dry or partially saturated air, Btu per lb per F deg
ρ = density of air at lower temperature, lb per cu ft
cfh = volume of air at lower temperature, cu ft per hr
Δ = dry bulb temperature rise, F deg.

Also;

$$\text{cfh} = W/\rho \quad \text{.....[2]}$$

or,

$$Q = 0.24\ W\Delta \quad \text{.....[3]}$$

and,

$$\text{cfm} = W/(60 \text{ min} \times \rho) \quad \text{.....[4]}$$

or,

$$Q = 0.24 \times 60 \text{ min} \times \rho \times \text{cfm} \times \Delta \quad \text{.....[5]}$$

or,

$$Q = 0.24 \times W \times \Delta \quad \text{.....[6]}$$

where:

W = lb of air per hr.

The nomograph on the next page solves Equations 4, 5, and 6 graphically. In using the chart, if any value falls beyond the range of values listed, a multiplication or division by 10 or 100 will bring the value into range. For example, if the cfm value is multiplied by N, then W and Q are each likewise multiplied by N.

The chart is used by reading from cfm to ρ to W and W to Δ to Q.

Example 1:

If 50,000 cfm of air at zero F and with 0.085 lb per cu ft density enters a building, and the desired room temperature is 60 F, what is the heating load?

Solution: Align cfm = 5000 (10) with ρ = 0.085 and read W = 25,500 (10). Align W = 25,500 (10) with Δ = 60 and read Q = 367,000 (10) = 3,670,000 Btu per hr.

Example 2:

How many Btu are required to heat 40,000 cfm of air with a density of 0.0755 lb per cu ft and a dry bulb temperature rise of 23 F deg?

Solution: Align cfm = 4000 (10) with ρ = 0.0755 and read W = 18,100 (10). Align W = 18,100 (10) with Δ = 23 and read Q = 100,000 (10) = 1 million Btu per hr.

Example 3:

How much air is needed to *remove* 100,000 Btu per hr, with 0.0755 lb per cu ft air rising 23 F deg dry bulb?

Solution: Align Q = 100,000 with Δ = 23 and read W = 18,100. Align W = 18,100 with ρ = 0.0755 and read cfm = 4000.

Example 4:

If 240,000 Btu per hr is removed from 10,000 lb per hr of air entering a building at 150 F, what is the final air temperature?

Solution: Align Q = 240,000 with W = 10,000 and read Δ = 100. Therefore the final temperature = 150 − 100, or 50 F.

Example 5:

A 95 percent efficient, 1800 bhp motor is to be cooled with enough air to keep its temperature at 100 F or less. If the structure in which it is enclosed is at 5000 ft elevation and the entering air temperature is 70 F, how much cooling air is required?

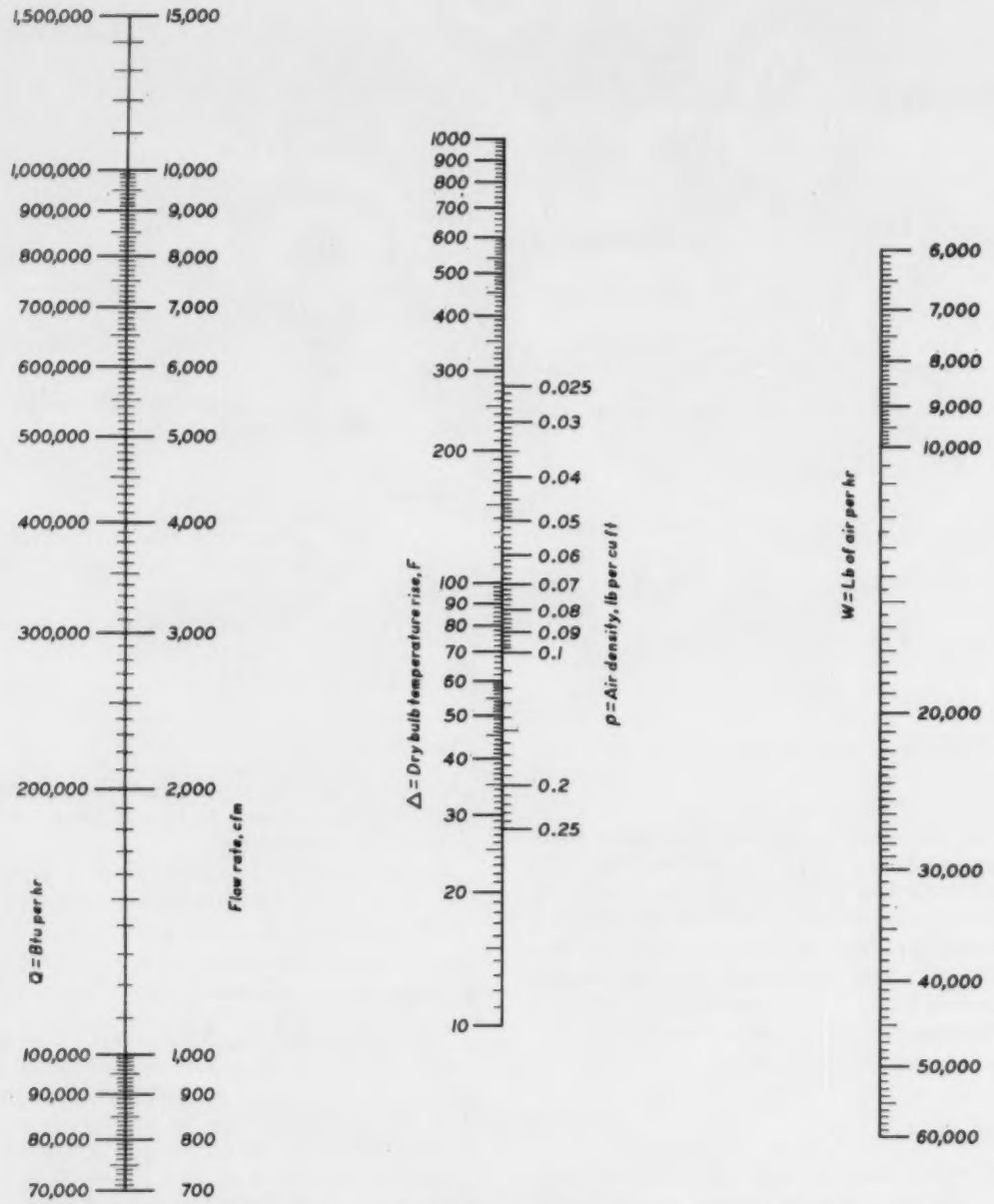
Solution: Air density at 5000 ft and 70 F = 0.0624 lb per cu ft. Motor heat to be absorbed by

Tear out along this line

HPAC DATA SHEET

air = (1800 hp) (1.0 − 0.95 = 0.05) (2547 Btu per hr per hp) = 230,000 Btu per hr. Δ = 100 − 70 = 30 F deg dry bulb temperature rise. Align Q = 230,000 with Δ = 30 and read W = 32,000. Align W = 32,000 with ρ = 0.0624 and read cfm = 8500.

The foregoing examples show the versatility of the nomograph in making quick calculations of either Btu input to meet heat requirements or air flow rates for desired heat removal. Temperatures and pressures given are within the range usually encountered in engineering calculations. ≠



NOMOGRAPH gives quick answers to such questions as: What additional heating capacity is required to temper outdoor ventilation air? How much outdoor air is needed to dissipate heat released from hot equipment? How to use it is explained on preceding page

Revise ASA Butt Welding Standards To Simplify Layout, Fabrication

. . . *of piping systems*

BY H. H. GEORGE
Manager, Research Section
Product Engineering and Research Dept.
Tube Turns Div.
Chemetron Corp.

CHANGES that should help simplify piping layout and fabrication are features of the latest revisions of two American Standards: B16.9, covering steel butt welding fittings, and B16.25, for butt welding ends.

The revisions have been approved by the American Standards Association and are published by the American Society of Mechanical Engineers as ASA B16.9-1958 and ASA B16.25-1958. Both Standards are sponsored jointly by the Mechanical (Heating, Piping, and Air Conditioning) Contractors Association of America, the Manufacturers Standardization Society of the Valve and Fittings Industry, and the ASME. This article will briefly discuss their highlights.

Revised B16.9 keeps pace with strides in piping field

The American Standard for steel butt welding fittings was first published in December 1940. A revision approved in April 1951 extended the size range to 24 in. fittings and added reducing tees and heavy wall caps. Further revision was begun in 1955 in order to keep pace with advancements in the piping field. These changes were approved in 1958 and the new edition of the Standard was issued in June.

• American Standards—B16.9, covering steel butt welding fittings, and B16.25, for butt welding ends—have been revised. Changes in B16.9 provide new safeguards against improper and inadequate marking of fittings, list standard dimensions for most 22 in. fittings, present additional data for 14 in. and larger straight and reducing tees, and outline new recommendations for end preparation of fittings. In the new edition of B16.25, the increasing interest in thin wall pipe is reflected by separate listing of end preparation requirements for carbon alloy and ferritic alloy steels and for corrosion resistant materials. The new provisions also take into account recent shop and field experience and tend to make the Standard more realistic by modifying unwarranted tolerance or finish regulations. Additionally, outside diameters of cast valves have been increased to conform with current industry requirements.

Mr. George was graduated from the University of Pittsburgh with a Bachelor of Science degree in physics and engineering in 1935, and received his M.S. degree in physics from the same institution in 1939. He is responsible for the design of all of Tube Turns' piping components. His principal professional interest lies in the field of metal fatigue and he has written several articles for Heating, Piping & Air Conditioning.

One of the important changes in the 1958 edition relates to the more stringent requirements for permanent markings. The 1951 version did not require that wrought carbon steel fittings be permanently marked. Problems directly traceable to improper identification of fittings have multiplied since 1951, particularly in the wake of the influx of fittings of foreign manufacture. Hence, the 1958 edition requires that all fittings, both cast and wrought, be permanently marked to show the following: manufacturer's name or trademark, schedule number or nominal wall thickness, material, and size.

The increasing number of applications for 22 in. pipe, especially in cross-country pipeline work, is recognized in the revised Standard by including dimensions for 22 in. elbows, returns, tees, stub ends, caps, and reducers.

The 1958 revision reflects continued efforts by some leading manufacturers to standardize on center-to-end outlet dimensions for straight and reducing tees 14 in. and larger. In earlier editions, no data was given on this dimension for tees larger than 12 in. The revised Standard lists "recommended but not mandatory" center-to-end outlet dimensions for tees 14 through 24 in. Suggested dimensions are those currently used by most manufacturers of welding tees.

Modify End Preparation Requirements

The new specifications for end treatment still retain requirements that assure uniform and reliable performance. These new changes are discussed more fully elsewhere in this article and it suffices here to state merely that ASA B16.25-1958 is incorporated in the new version of B16.9. For practical purposes, the changes eliminate the U-bevel as a standard lip design for thicknesses over 3/4 in. and provide that the 37½-10 deg compound bevel shall be used for thicknesses greater than 3/4 or 1 in. at the manufacturer's option. Also deleted is the statement calling for producer-user agreement on end preparation for thicknesses greater than 1¾ in. Such thicknesses will now receive the 37½-10 deg compound bevel, unless otherwise specified by the purchaser.

Similarly, tolerances for lap joint stub ends have been modified. The new variations for outside diameters of the laps — +0 in., −1/32 in. for nominal sizes ½ in. through 8 in. and +0 in., −1/16 in. for nominal sizes 10 in. through 24 in. — will not cause interference if the stub end is mated to a large female facing, the only instance where the dimension is likely to be critical. Experience has shown that the previous close tolerance of ±1/64 in. is unwarranted.

Previous tolerances for the outside diameters for the barrels of stub ends were developed in 1950 and were based on the variations then permitted for the outside diameters of random pipe which is used in manufacturing these fittings. However, random pipe now being produced exceeds these tolerances and it has become uneconomical to make stub ends without exceeding the tolerances previously allowed. In the new Standard, the tolerances are not listed as such; instead, maximum and minimum OD specifications for the barrel are now shown in the separate dimensional table for lap joint stub ends. Incidentally, the minimum outside diameter is unchanged from 1/32 in. under nominal.

Clarify Areas of Confusion

Two other changes in B16.9 clear up former areas of confusion to the engineer and manufacturer alike. First, the new Standard states specifically that fittings made to special dimensions or of materials not covered by it shall be considered as complying with the Standard if all other stipulations in the Standard are met. Previous wording did not provide so clear-cut a statement on this subject.

Secondly, in the 1958 edition the thickness, t, used in determining the computed bursting pressure by the Barlow formula of fittings made to this Standard, is defined explicitly as the minimum pipe wall thickness; 87½ percent of the nominal thickness of the pipe for which the fitting is recommended. Previously, this factor for the formula was loosely identified as the "appropriate section of the Code for Pressure Piping," and frequently the engineer and manufacturer had no idea which section of the Code should apply.

New B16.25 revises lip design, contours, valve ODs

American Standard B16.25 results from the need in the piping industry for a standard on the end preparation of pipe, valves, welding neck flanges, and pipe fittings to be joined by butt welding. It was first published in 1955 and the 1958 edition represents the first revision. Of particular interest, in reviewing the revision, are the requirements for lip design, contours, and cast steel valve ODs. Typical sections illustrating the new lip design and contour requirements are shown in Figs. 1a, 1b, 2, and 3.

The increased use of thin wall pipe and corrosion resistant materials has been recognized, and design requirements are specified for carbon and ferritic alloy steels and for corrosion resistant materials. These are summarized in the following table:

Carbon and ferritic alloy steels, nominal wall thickness, in.	End preparation	Corrosion resistant materials, nominal wall thickness, in.
Less than 3/16	Square or slight chamfer	Less than 0.083
3/16 through 3/4 (or 1)[1]	Slight chamfer 1/16 in. land, 37½ deg bevel	0.083 through 1/8 Over 1/8 through 3/4 (or 1)[1]
Over 3/4 (or 1)[1]	1/16 in. land, 37½-10 deg bevel	Over 3/4 (or 1)[1]

[1]Fabricator's option.

Another significant change, it may be noted, is the

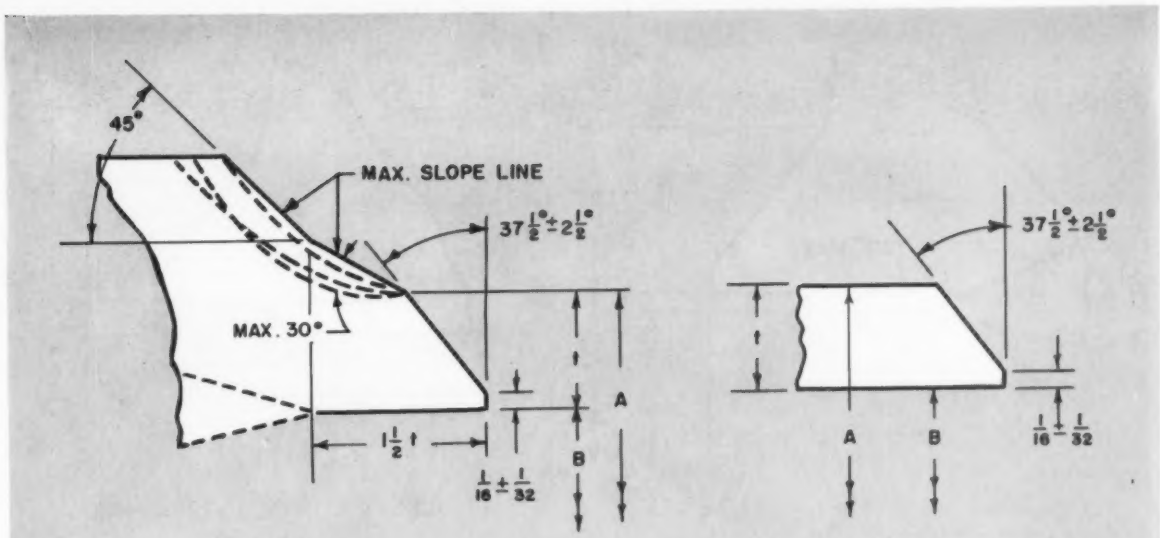


FIG. 1a

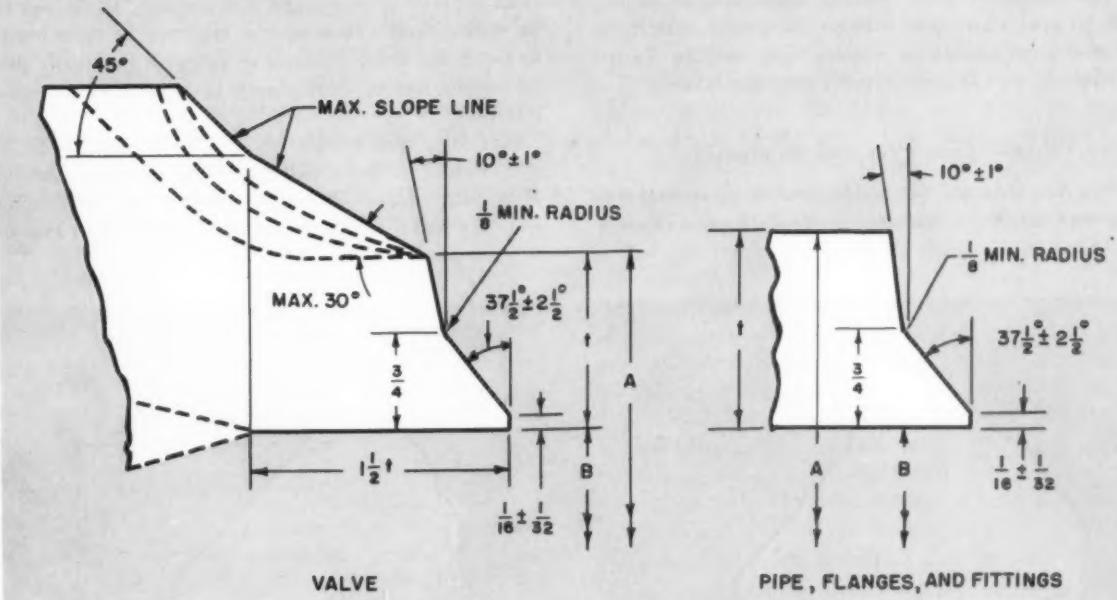
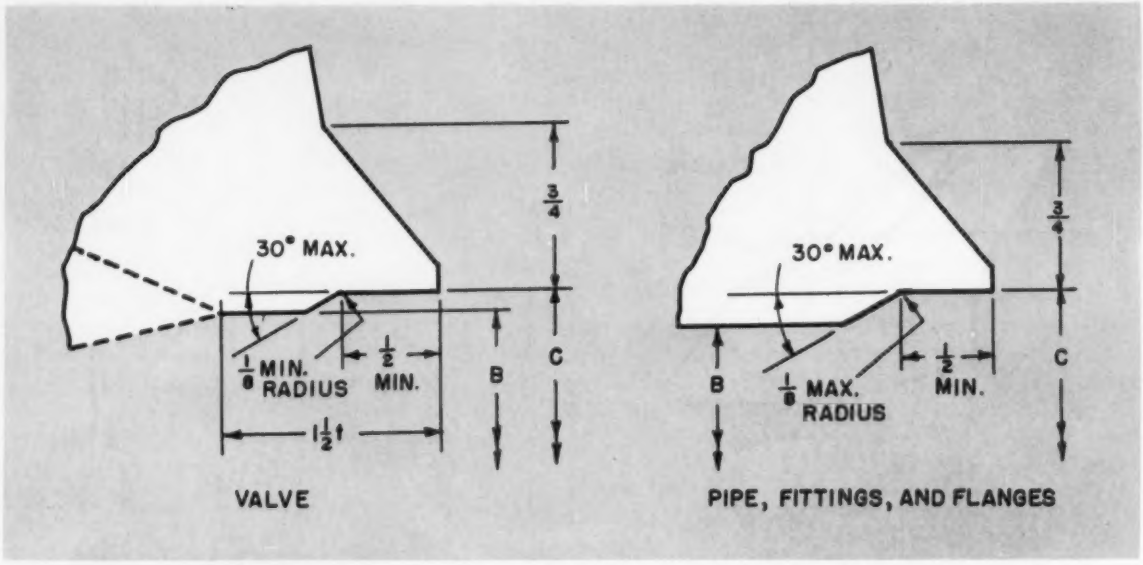


FIG. 1b

1 TYPICAL BUTT WELDING end sections (without backing rings or with split backing rings) as defined by revised ASA B16.25 are shown above. Fig. 1a represents pipe wall thicknesses, *t*, of 3/16 to ¾ in. Fig. 1b depicts thicknesses greater than ¾ in.

provision for use of the single bevel for nominal wall thicknesses from ¾ through 1 in. at the fabricator's option. From shop practice and experience, it has been found impractical to machine the ⅛ in. radius and start the 10 deg bevel when wall thicknesses were only slightly over ¾ in. For example, a wall of 13/16 in. would have no perceptible change in contour with a 37½-10 deg combination bevel. It is more practical to continue the 37½ deg bevel over the full thickness. The fabricator, at his option, may adopt this practice.



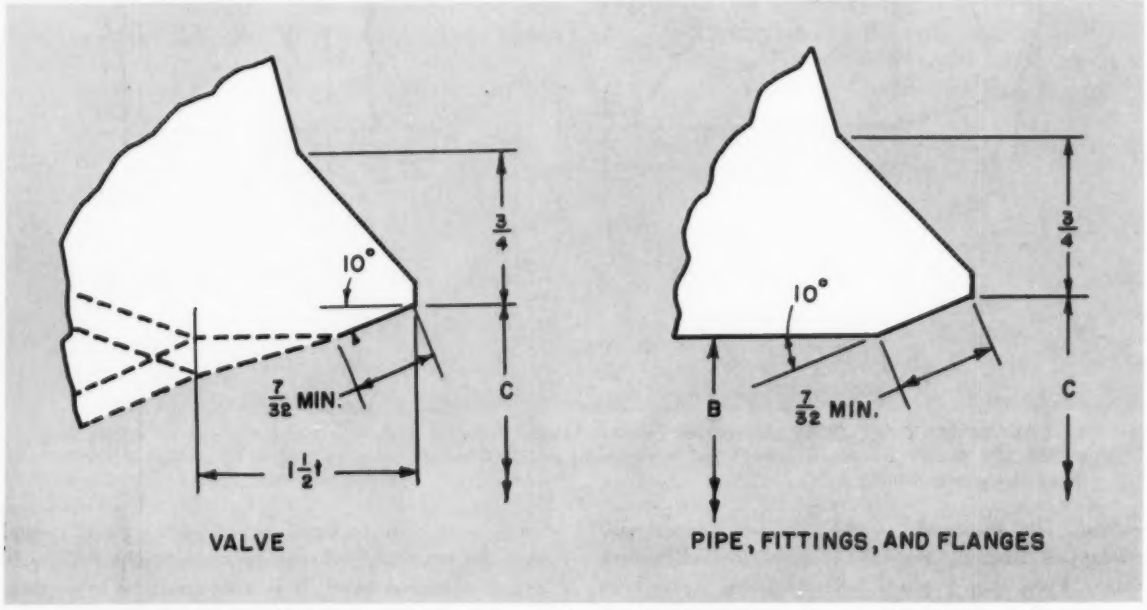
2 BUTT WELDING ENDS with continuous rectangular backing rings (inside contour) should be prepared as illustrated here, according to 1958 version of ASA B16.25

The compound 37½ - 10 deg bevel will, of course, still be used where wall thickness is greater than 1 in. However, the change in contour may now be started at either ¾ or 1 in., whichever is more desirable.

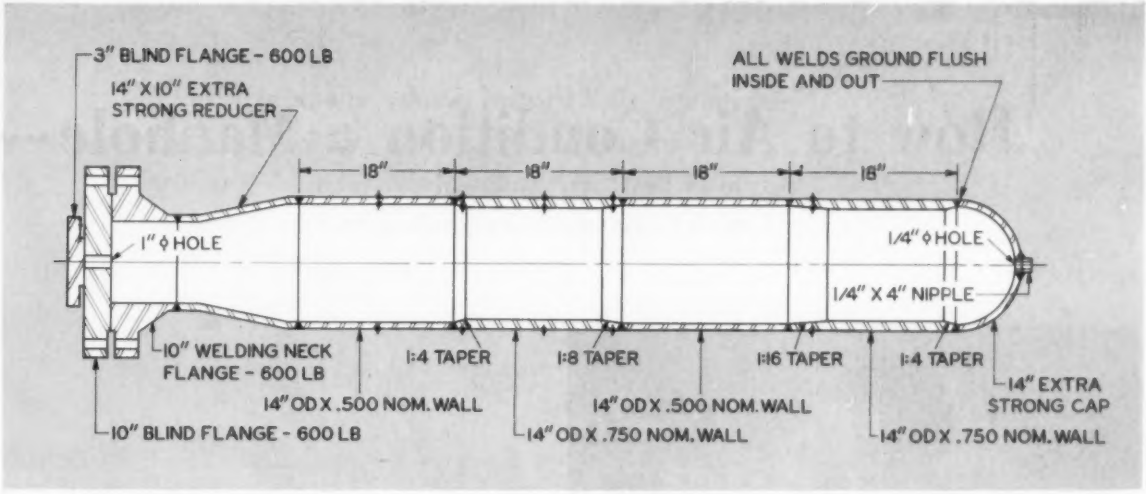
More Valuable from Practical Standpoint

New requirements for inside contour treatment also represent an attempt to make the Standard more valuable from a practical standpoint. For instance, all fittings to be used without a backing ring may now be taper bored to match the inside diameter of the pipe. Previously this exemption was applicable only to welding elbows and returns.

Similarly, considerable changes have been made in the wording of those sections of the Standard relating to transition tapers. When the thickness of the welding end of a valve, fitting, or flange is greater than that of



3 REVISED STANDARD B16.25 requires that butt welding ends with continuous taper backing rings (inside contour) be prepared in this manner



4 TO TEST internal transition tapers between fittings and pipe having dissimilar yield strengths and wall thicknesses, a specimen of this detail was used. Specimen was subjected to hydrostatic yield and burst tests; strain gage and diametral expansion measurements were recorded at various pressures

the matching pipe, transitional slopes not exceeding 1:3 (18.4 deg) may be provided, as outlined below:

Extra thickness on OD	*Extra thickness on ID*
1) Taper weld	1) Taper bore
2) Taper OD from welding level	

It should be noted that these tapers apply only when the additional wall thickness is required for the design strength of the joint. Where the wall section is greater than required for design strength, the additional metal may be tapered on the outside diameter by the permissible maximum 30-45 deg combination slope, or the inside diameter may be sloped by a contour which avoids sharp re-entrant angles.

Another addition to the Standard provides that, when the inner contour beyond the welding end of a butt welding fitting is less than nominal, the fitting shall be taper bored at approximately 1:3 taper.

Test Internal Transition Tapers

Tests have recently been conducted on internal transition tapers between fittings and pipe having dissimilar yield strengths and wall thicknesses. Details of the specimen employed are depicted in Fig. 4. Three transition tapers—1:4 (14 deg), 1:8 (7.1 deg), and 1:16 (3.6 deg)—were provided between the 14 in. OD × 0.500 in. wall, 53,000 psi yield pipe and the 14 in. OD × 0.750 in. wall, 37,500 psi yield pipe. The test specimen was subjected to hydrostatic yield and burst tests, with electric strain gage and diametral expansion measurements recorded at various pressures.

Results of these tests indicate that:

1) The tapers had no apparent effect on burst strength.

2) The midpoint of each taper yielded (0.2 percent offset criterion) at pressures equal to or slightly more than the yield pressure of the 0.500 in. wall. Therefore all tapers tested had adequate yield strength.

3) Initial plastic strains may occur first in the transition tapers. But, in the course of plastic straining, the tapered sections are supported by the adjacent heavier wall pipe ("a bridging effect") and the plastic strains become greatest in the thinner wall pipe. Measured plastic strains at the welds were comparatively small, indicating that the weld metal had a higher yield strength and/or work hardening rate than the metal in either pipe.

4) The trend of the results showed that the slopes of the transition tapers probably should be no less than 1:16 (3.6 deg).

It should be noted here that the optimum taper must be a compromise between the static and the cyclic conditions. The above test results are based on static tests only. From a fatigue standpoint, a small taper slope is desirable since tapering minimizes the stress-intensifying notch effect. To provide adequate static strength, the taper slope must also be sufficiently large, so that the thinner end will receive reinforcement from the thicker section (again, the "bridge effect").

Another significant change in the Standard concerns outside diameter dimensions for cast steel valves. These diameters have been made equal to the nominal pipe outside diameter, plus 15 percent of the nominal wall thickness of the heaviest matching pipe, rounded off to the next highest thirty-second of an inch. The new tolerance for this dimension is +0 in.,—1/32 in. Previously the tolerances were +15 percent of the nominal wall thickness,—0 in. Incidentally, the new dimensions are included as a separate listing in Table 1 of the revised Standard. ≠

Figs. 1a, 1b, 2, and 3 extracted from American Standard B16.25-1958, with permission of the American Society of Mechanical Engineers.

How to Air Condition a Manhole.....

MANHOLE must be dry. Here, readings of wet and dry bulb temperatures are being taken from psychrometer. Normal working conditions require 75 F DB, less than 20 percent RH

EQUIPMENT trailer (rear) supplies conditioned air to splicers' shanty (foreground) through flexible duct. Air delivered to manhole is usually admitted through same hole company uses for cable pulling

That's right, a manhole. Detroit Edison does it—via a special air conditioning equipment trailer—to meet temperature and low humidity requirements of underground electrical cable splicing operations.

WHAT'S it like down a manhole these days? It's anything but wet, clammy, and too hot or too cold to service men of Detroit Edison Co. The need for low humidity in electrical cable splicing has made on-the-job air conditioning an absolute necessity in underground power line maintenance.

Human comfort is not the big reason. A series of tests conducted by the company's cable division relevant to splicing work indicated that work could be done effectively on splicing as long as the relative humidity was below 20 percent. Above this point, insulation provided by the taping breaks down. The result can be a break in power transmission.

Temperature is important, too, because the men must be comfortable to avoid contamination of the insulation by perspiration from their hands.

Calculate Cooling Load

Air conditioning is "delivered" to the job via an equipment trailer. This unit normally arrives on the site at least 12 hr before work is to start. This allows time to dry out the manhole so work can begin under ideal conditions. Operating conditions usually require 75 F dry bulb, with less than 20 percent relative humidity.

In determining the dehumidifying requirements, it is assumed that the manhole floor is covered with water, a condition which is actually encountered in some instances. Other factors adding to the cooling load are body heat, lights, hot plates, conduction, and warm brine returned from the concentrator. Makeup air at the rate of 40 cfm is added to the system to insure a positive pressure at all times and to provide ventilation.

Use Dual Purpose Refrigeration

After finding the cooling load and the number of grains of moisture per pound of air to be removed, the next problem was finding a way to fulfill these requirements. The company had two alternatives:

1) Use chemical methods of dehydration to remove moisture

2) Use refrigeration for cooling and drying.

Design engineers decided that refrigeration was the answer, since chemical dehydration could only reduce moisture.

Refrigeration, on the other hand, could provide dehumidification and control of dry bulb temperatures and meet the limited space requirements consistent with the size of the trailer.

Subcooling is necessary to achieve the prescribed low relative humidity. Circulated air (350 cfm) is cooled to 10 F by passing it through a 10 row deep brine sprayed finned coil to reduce moisture, then reheated by electric strip heaters to proper temperature (55 to 127 F) to maintain the manhole at 75 F in all seasons.

The coil is cooled by refrigerant No. 12 controlled by a thermostatic expansion valve set to maintain 5 F superheat in the refrigerant leaving the coil.

Ice is kept from forming on the coil by spraying with a glycol solution. As the glycol solution becomes diluted with water condensed from the air, its volume increases and a float switch is activated. The float switch opens a solenoid valve that allows part of the solution to flow to a concentrator where it is heated to 140 F by electric heaters and moisture is driven off. The concentrated solution is returned to the system through a heat exchanger, exchanging heat to the solution coming to the concentrator.

A 10 hp air cooled condensing unit with an open type, belt driven compressor completes the refrigerant cycle.

The actual calculated cooling load is approximately 2.7 tons. Because of the extreme low side and high side pressure conditions a 10 hp compressor was selected.

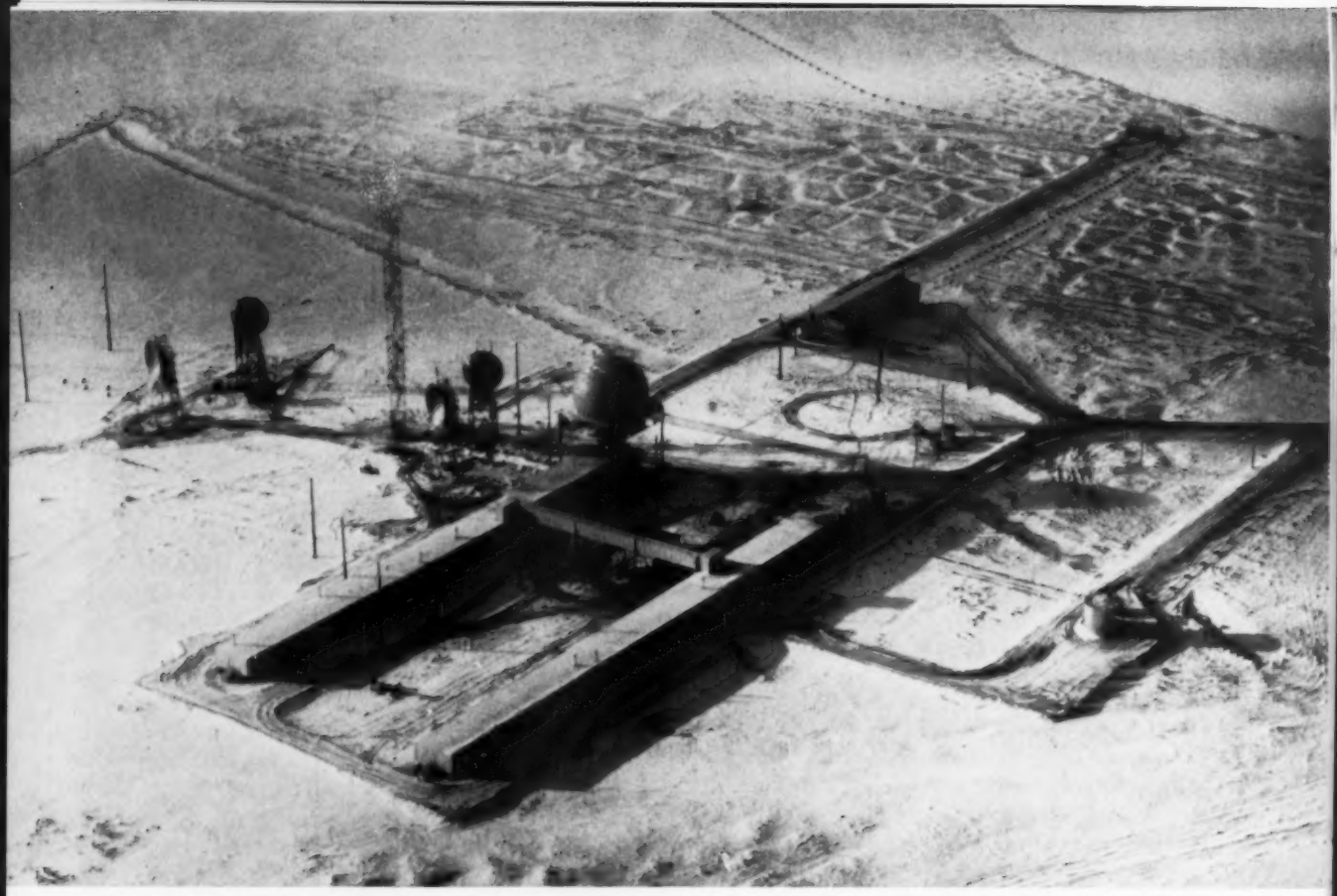
Tap Overhead Power Line

The whole unit operates on a three-phase, 220 volt line. Overhead lines crewmen tap an overhead cable for the power source and a three-phase service drop is installed in the splicers' shanty next to the air conditioning trailer.

Phase indicating equipment is installed in the trailer to insure correct rotation of all motors on startup at each new location.

The trailer must be on level ground so the float valves in the sumps can work correctly. Where this is not possible, leveling is accomplished using hydraulic jacks.

Assisting Detroit Edison with the design of the equipment was Hyde & Bobbio, engineering consultants. ‡



Waste Heat Recovery System Keeps Arctic Outpost Warm

. . . for DEW Line radar station personnel when the mercury plummets to —60 F

BY HENRY VAUGLE
Mechanical Engineer
Western Electric Co., Inc.

WESTERN Electric Co. defense project engineers, responsible for the design and construction of buildings to house DEW (Distant Early Warning) Line personnel and equipment, regarded the problems of heating and ventilation as major considerations. The terrible wind-driven cold of an Arctic winter, ranging from −40 to −60 F, creates a temperature differential ranging up to 130 F deg, far in excess of anything encountered in heating design for temperate latitudes.

The heat loss, even assuming optimum insulation, is necessarily rapid, calculated at well over 400,000 Btu per hr for the structures used in DEW Line installations. Required was a continuing supply of heat, with provision for supplementary and emergency heat generating sources, as even relatively short interruptions in the flow of heat would result in extreme discomfort and danger to personnel. The Arctic climate makes no allowances for equipment failure.

Providing a constant large volume

In designing the heating and ventilating system for this DEW Line radar outpost in the Arctic, the engineers pondered two big problems: temperatures down to −60 F and very high fuel costs due to the remoteness of the site. The great amount of electricity generated to operate electronic radar equipment gave rise to an investigation of the possibility of recovering waste heat from the diesel engines that turn the generators. The outcome is a system which reclaims heat from the jacket cooling water and exhaust gases of the diesels and serves as the primary heating source for the whole installation. Ventilation is provided by special facilities which mix hot return air from equipment with incoming air to maintain supply air at proper temperatures.

Before joining Western Electric Co. in 1955, Mr. Vaugle was employed as a mechanical engineer with several consulting firms and the architectural and engineering unit of the New York City Board of Higher Education. He has an M.E. degree from the College of the City of New York and is a registered professional engineer.

source of heat, apart from all other considerations, is in itself not an unusually difficult problem. Reduced to its simplest elements, the provision of a greater amount of heat involves the consumption of a greater amount of fuel. However, it is precisely on that point that heating engineers on the DEW Line project met with a serious complication — one embodying the peculiar economics of Arctic operation.

Fuel, because of the extreme difficulty of transportation, is very expensive in the Arctic. Oil brought in by tanker, during the short period that sea lanes are open, costs about four times as much as in the U. S. Oil in drums, that may come in as deck cargo on freighters, might cost seven times as much as it would in this country. There are a few sites that can be supported only by air delivered supplies. Where air lift is the only transportation possible, oil in drums costs as much as $3.75 per gal — *more than 19 times* its average cost in the U.S.

In addition to these major considerations, the problem of heating system design required considerable attention to the details of design simplicity for ease of operation and maintenance, and to the limitations of space which affected the design of all equipment. The requirements for the greatest degree of dependability in the primary heat source and the provision of an emergency source of heat were among the most important elements of the problem.

This project is an outstanding example of integrated engineering, wherein the efforts of one group of engineers were related to the efforts of all others. No segment of the job could be considered apart from the whole and the solution of one aspect of engineering could only be made in relation to the entire problem. Thus, the engineers regarded the objective of heating and ventilating the buildings as one aspect of the entire assignment.

Explore Waste Heat Recovery

A requirement of DEW Line operation, even more fundamental than that for space heating, was the requirement for power—the electricity of various characteristics that was needed to operate the complex electronic searching and tracking equipment. This power is furnished in DEW Line locations by diesel engines, constantly turning generators to provide an uninterrupted flow of current. The prime product of

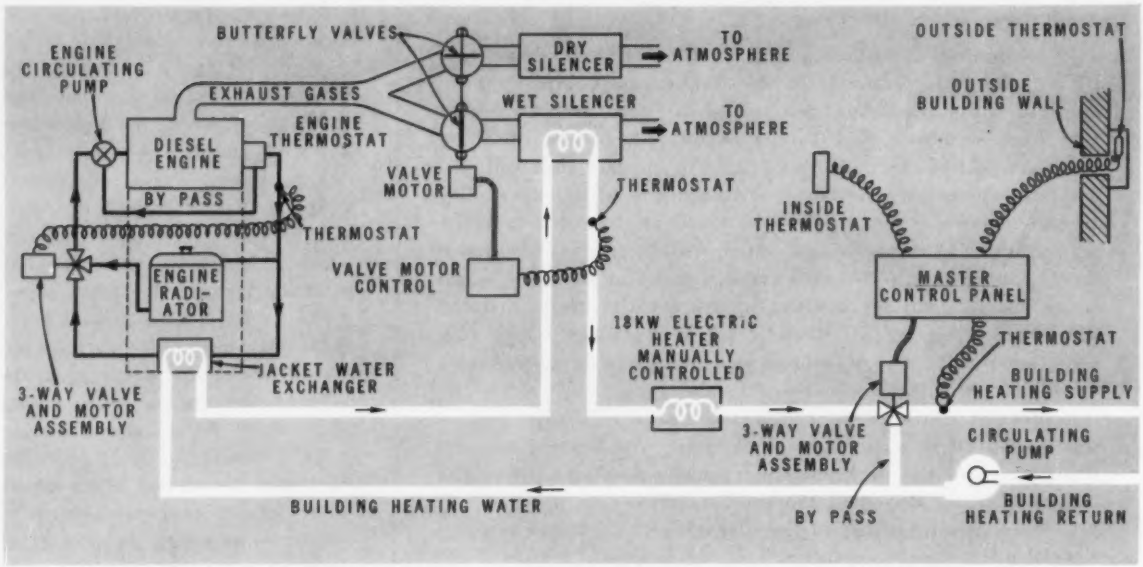
TABLE 1—OPERATING CONDITIONS of diesel generators *vs* amount of heat reclaimed for various engine loadings listed below

Engine loading	Temperatures, F						Engine loading	Heat Reclaimed, Btu per hr			
	Jacket water exchanger		Wet silencer exchanger					One engine			Two engines
	Heating system water		Heating system water		Exhaust gases			Jacket water exchanger	Wet silencer exchanger	Total per engine	
	In	Out	In	Out	In	Out					
Full	150.2	165.0	163.0	183.0	578.3	204.6	Full	96,850	151,116	247,966	495,332
¾	150.4	161.0	158.5	176.4	508.0	201.0	¾	79,500	134,200	213,700	427,400
½	150.4	159.1	157.2	169.6	420.0	188.0	½	65,200	93,000	158,200	316,400

TABLE 2—REQUIRED HEAT at various outdoor temperatures and required diesel operation to supply this heat are given here

Outside temperature, F		−60	−40	−30	−20	−10	0	+10	+20	+30	+40	+50
Total auxiliary site, per building, heat loss, Btu per hr		504,000	426,800	388,000	350,000	310,000	272,000	233,000	194,000	155,000	116,000	77,500
Required diesel operation, load point of engines	No. 1	¾+¼*	¼	¼	¼	½	½	½	½	½	½	½
	No. 2	¾	¼	¼	½	½	½	½	½	½	½	½
Total reclaimed heat, Btu per hr		522,866*	427,400	427,400	371,900	316,400	Heat partially reclaimed over this operating range.					

*Electric heater required.



PRIME HEATING SYSTEM of DEW Line station shown schematically. Actually, jacket water exchanger and wet silencer of all diesel engines are part of system, but for simplicity only one engine's heat exchangers are shown

diesel engine operation is mechanical turning energy. A secondary byproduct is heat, which in temperate and warm climates is usually dissipated as waste heat through the engine's cooling and exhaust systems. However, in the Arctic, heat in any form is an extremely valuable product and this source was examined very carefully.

Initially it was felt that the waste heat from the diesels could reduce the amount of heat which would be required from a boiler. However, preliminary calculations pointed to the encouraging theoretical conclusion that enough heat could be extracted from the diesels' cooling water and exhaust gases by using appropriate heat exchangers to provide the entire space heating needs of a DEW Line location. These calculations were subsequently confirmed by actual laboratory tests with experimental equipment. Adequate space heat could be provided by the power generating equipment without additional expenditures of fuel.

Calculate Heat Losses

The quantity of heat required was determined by calculating the building heat losses. Wall, floor, and ceiling construction consist of 4 in. or 8 in. thick insulated plywood panels having corresponding U values of 0.1 and 0.08, but the more conservative value of 0.1 was uniformly used in calculating the losses through all wall, floor, and ceiling surfaces.

A series of heat loss calculations was made for temperature difference values up to 130 F deg. This maximum combines the lowest expected outside temperature of −60 F with the desired inside temperature of 70 F. An outside temperature of −40 F is considered to be an average low Arctic winter temperature according to published climatological data.

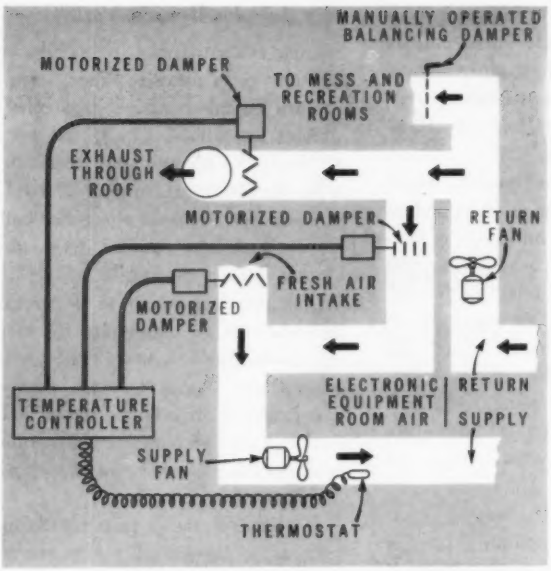
The heat loss of an auxiliary site at an outside temperature of −40 F was calculated to be 426,800 Btu per hr. The results of the diesel engine heat reclamation experiments indicated that the heat produced by the normal operation of two engines at three-fourths of full load was 427,400 Btu per hr. Tables 1 and 2 record experimental data including the heat extracted from both the jacket cooling water and exhaust gases for various load conditions of the engines. The table of calculated heat losses for different outside temperatures indicates the number of engines and respective loading required to balance the heat losses.

For all outside temperatures down to −40 F, the heat reclaimed from a normal predicted electrical power loading of the diesel engines (two engines at three-fourths full load) was found to be sufficient to equal the losses.

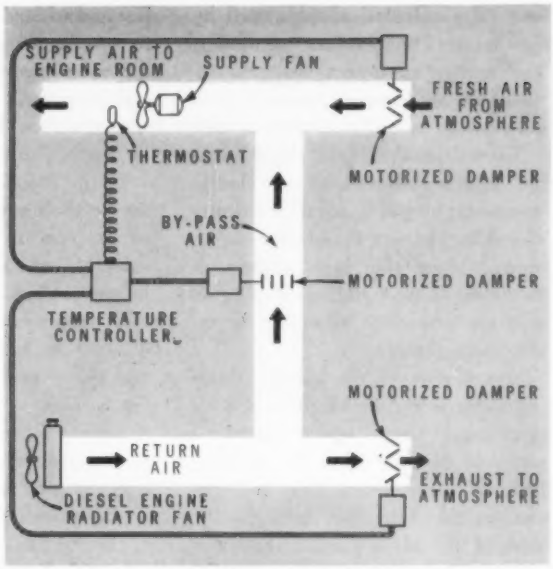
On the basis of this investigation, it was decided that a system of reclaiming heat from the jacket cooling water and exhaust gases of the diesel engines used for power generation would be acceptable as the prime source of space heat. A supplementary electric heater would serve as a source of additional heat in the event of extraordinary drops in outside temperature. In the case of main stations, the reclaimed heat from diesel operation is sufficient to equal losses at the low temperature of −60 F, and no electric heater is provided.

How System Operates

Extracting heat from the diesel engine jacket cooling water involves the use of a tube-and-shell heat exchanger which is connected in parallel with the engine radiator, as shown in Fig. 1. Once the engine has come up to the normal operating temperature, the diesel jacket water is diverted from the radiator to the heat exchanger by the action of a three-way valve



ONE OF TWO electronic equipment room ventilation systems illustrated. Duct, at top, supplies other rooms with warm air



EACH DIESEL ENGINE has a ventilation system using its own radiator fan, lower left, as a return air fan

which is controlled by a temperature sensing bulb located where the jacket cooling water leaves the engine.

The diesel jacket temperature control system is designed with the primary objective of protecting the diesel engine by maintaining the jacket temperature at the specified value necessary for trouble-free diesel operation. Thus, the amount of heat available varies with the loading conditions of the engine and the resultant temperature rise of the building heating water varies from 10 to 13 F deg.

The extraction of heat from the diesel exhaust gases takes place in the wet silencer which is also a form of tube-and-shell heat exchanger. Receiving water previously heated by the jacket water heat exchanger of the same engine, the wet silencer raises its temperature even higher (12.5 to 20 F deg).

Control of the heat recovered from this source is accomplished by controlling the amount of the gases which flows through the wet silencer. Regulation of the flow of the exhaust gas is achieved by means of electrically operated butterfly valves located in each of the Y-branches of the exhaust piping leading from the diesel engine to the wet and dry silencers, respectively.

Butterfly valves are mechanically linked to operate together in reverse fashion so that when one is fully open the other is fully closed. These may be moved to any intermediate position between the open and closed positions in response to the demands of the temperature controller and its associated temperature sensing bulb located at the water outlet of the wet silencer; thus maintaining this water at a constant temperature.

As a safety precaution, operation of the valves is interlocked with the building heating circulating pumps so that no gases can pass through the wet silencers unless water is circulating through them also; thus precluding the possibility of generating steam inside them.

A third heat source is provided for use when outside temperatures become unusually low. An 18 kw electric booster heater is located so that it can further increase the temperature of water which has left the wet silencers. The action of the heater is two-fold: First, by creating a demand for electrical power, it increases the operational load on the diesel engine generators amounting to about one-fourth of a single engine's full load; in turn, increasing the heat available for recovery. Second, by virtue of its own electrical output, it contributes 61,200 Btu per hr.

A standby or emergency heat source is supplied by a compact package type, oil-fired, hot water heating boiler with a rated output of 450,000 Btu per hr and capable of satisfying the full building heat load when the outside temperature is −40 F. This boiler supplies the necessary building heat in the event of a partial or complete breakdown of the diesel engines or any other critical part of the heat reclamation system.

Flow of hot water through the boiler is accomplished by manually opening the valves between the circulating lines and the boiler. From that point on, boiler operation is controlled by the central heating panel control.

How Controls, Pumps Operate

The building heating control system maintains the desired uniform inside temperature by regulating the temperature of the building heating water which is pumped at a constant rate through the system. Control of this water temperature is achieved by mixing water returned from the distribution system (about 150 F) with hot water (about 180 F) from the heat sources by means of a three-

way valve automatically operated by the master temperature controller. The master controller, in turn, responds to information received from both inside and outside thermostats.

The outside thermostat supplements the supreme control of the inside thermostat by giving advance warning of sudden changes in outside temperatures, since the high degree of insulation in the buildings would prevent an immediate effect on the inside temperature.

Distribution of the building heating water is accomplished by a 3 hp centrifugal pump which circulates water at 45 gpm from the building heating water return line and discharges the water into both the bypass to the main control three-way valve and the line returning to the heat sources. Although only one pump is required at a time, an additional standby pump is provided.

The distribution system in the buildings is essentially a conventional one, including supply, return, and reverse return mains with associated finned tube convectors and hot water unit heaters. The electronic equipment rooms and diesel engine rooms are not heated by this system, since the equipment they contain liberates so much heat that some of it must be removed.

Recirculate Ventilation Air

In Arctic locations special provisions must be made for ventilating structures containing personnel and power equipment. If buildings similar to those used at DEW Line sites were erected in the U.S., adequate ventilation would be provided by the frequent entrance and egress of personnel. However, during an Arctic winter at DEW Line sites movement between indoors and outdoors is at a minimum, and windows are kept closed. Therefore, the air required for personnel, removal of heat from equipment, and diesel engine combustion and scavenging must be supplied by special facilities.

Because of the extremely low temperature, air could not be taken in from the outside without impairing the effectiveness of the heating system and without subjecting equipment to severe temperature variations. It did not seem feasible to provide special equipment for preheating ventilating air, so the problem was solved by recirculating the air.

In the diesel engine rooms, where the ventilation system is independent of the rest of the building, a considerable amount of heat is liberated by the engines. The fairly high summer temperatures cause an increase of this heat liberation, since the amount of heat reclaimed for building heating is then at a minimum. A large volume of air (19,000 cfm) is required, primarily for cooling two engines, combustion air needs being a minor portion of the total.

During the Arctic winter, hot air returned from the engine room is mixed with incoming air in order to maintain supply air at proper temperatures. This is done through motorized dampers in the intake, bypass, and exhaust ducts. The dampers are controlled by a thermostat in the supply air duct. There are three such systems, one for each engine.

Combustion air for the emergency boiler, located in a space adjoining the diesel engine rooms, is drawn from the exhaust plenum of one of the diesel ventilating systems by a fan. Since the emergency boiler would not be used unless it were necessary to shut down the engines, a low powered electric strip heater is provided on the suction side of the supply fan. The air is exhausted as part of the flue gases through the boiler stack.

A considerable amount of heat is generated by the electronic equipment and such heat must be removed in order to maintain proper operating temperatures. Here again the principle of recirculation is applied with effective results. A portion of the air that is carrying heat away from the electronic equipment is mixed with incoming low temperature air to raise supply air temperatures to the proper level.

Two similar ventilating systems are used for the electronic equipment rooms since space limitations do not permit the large size ducts that would be required for a single system.

Mix Supply, Return Air

Each system draws in outside air through a throwaway filter into a plenum chamber where it is mixed with return air. A supply fan takes air from the plenum and distributes it in the electronic equipment rooms through ducts located along the walls at ceiling height. Similar ducts, also located along the walls at ceiling height, return used air to the return fan where it goes either to the mixing plenum or out an exhaust to the atmosphere. Dampers in the exhaust and intake ducts and the return duct to the mixing plenum control the flow of heated air so that the supply air temperature is 60 F.

In one of these two ventilating systems, a portion of the warm air returned from the electronic equipment rooms is diverted for use as tempered ventilating air in living spaces located further down the building.

From these spaces, mess hall, recreation, hobby, and game rooms, this air is eventually exhausted to the atmosphere through separate fans and vents.

Use of return air from electronic equipment rooms to ventilate adjoining living areas conserves heat and obviates the need for air warming equipment.

In the remaining areas, remote from the power and electronic rooms, it is not necessary to draw in large volumes of air from the outside atmosphere for the purposes of cooling equipment. Normal space heat is considered adequate for bringing incoming air rapidly up to a comfortable temperature. However, a system of blowers is used to move air through this area and exhaust it to atmosphere. In this part of the building train, entrance and egress is most frequent and no special ventilating air intake system is provided.

By this system, several important objectives have been realized: fuel economy, dependability, simplicity in installation and maintenance, and adequate emergency protection. ‡

This article has been adapted from information appearing in The Western Electric Engineer.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam Lewis says

City Transportation Changes Present Many Opportunities

THE CHICAGO Transit Authority, the Windy City's public transportation operator, has published a fascinating new essay, *New Horizons,* containing profuse illustrations covering the past, present, and future transportation conditions there.

Mr. Gunlock, chairman of the CTA board, has done a progressive job. Engineers and contractors assuredly will be interested in the effects that must follow the growth of the city and in its physical reconstructions.

We dug wells down to rock and filled the wells with concrete to gain a stable support through the ancient clay for the steel columns of modern skyscrapers. Following this, the subways were squeezed through the clay without damaging the buildings.

The basements and sub-basements of several lofty buildings, especially as to heating and ventilation, were remodeled to permit sidewalk arcades along the sides of the new Congress St. Expressway.

The old buildings usually were equipped with steam supply main pipes in their attics. There were downfeed risers that terminated in horizontal return pipes in the basements. It was necessary to remove the radiators that heated the first story rooms along the Congress St. sides, and to divert the downcoming heating system pipes around the arcades. It was also necessary to increase the heat delivering radiator surfaces in the rooms above, below, and alongside the arcades.

In several cases the fire escape stairs from the upper stories above the arcades would have landed in the new streets with potentially disastrous interference with automobile traffic. The fire escapes accordingly were diverted safely, so as to deliver the escapees to sidewalks.

Specialized electric illumination was provided for the arcades, which in some cases required extensive rebuilding of the old interior conduits.

The Congress "subway," which strikingly travels outside through most of its length, is unique and seems to be a projected prototype for similar throughways in which rapid public transportation vehicles may occupy two lanes in the center of a wide street.

Insulated, warm, electric cables, wrapped about the floor drains exposed to outdoor temperature in some of the earlier Chicago subway entrances and in outside downspouts, are excellent protective devices against frost damage, and possibly are superior to pipes that carry a heated, nonfreeze liquid.

Parking lots along the suburban stations have proved so important that outlying multi-story facilities are projected, to enable commuters to leave their automobiles under proper protection during the business day. We have learned how to build these garages in downtown Chicago, but this experience will be extended to such structures as the possible "park 'n ride" ones near the stations along the principal suburban railways.

The electrical, drainage, and possible heating and ventilating services of such buildings are interesting. ⧺

Fan Noise in Air Conditioning: Let's Get the Facts Straight

BY W. E. TRACY
Sturtevant Div.
Westinghouse Electric Corp.

THE AIR CONDITIONING and ventilating industry has for many years found duct noise a disturbing problem. Until recently, an economical solution was unknown. In offices, hospitals, schools, and other areas where quiet is essential, fan and duct noises have been definite obstacles in providing imperceptable air circulation in air conditioning and ventilating systems.

The problem has become especially acute more recently with the development of high pressure systems which, while performing more efficiently, have a tendency to create more noise than conventional systems. Complaints and even litigation have caused great concern in many installations.

Technical information on noise generated by air handling systems has been limited and inadequate, and information on acceptable noise levels has not been available. Although most engineers have some familiarity with the decibel unit of noise, the problem of noise control is too complex for convenient solution. Moreover, noise control measures, to be efficient, should be designed by engineers specifically trained in acoustics. Attempts to "try it and see if it works" have generally been expensive and ineffective.

The decibel measures the magnitude of sound pressure. But because sound pressure is only one of the factors contributing to the loudness of noise, the decibel alone is not an adequate measurement of noise as it affects the human ear. The relative distribution of sound energy at different frequencies has a great effect on loudness. Therefore, noise must be described not only in terms of its pressure in decibels, but also in terms of its energy content at different frequencies. These factors must be considered in devising adequate controls for air conditioning and ventilating noises.

Any centrifugal fan or air distribution unit operating against a static pressure of 1 in. or greater, located in close proximity to the conditioned space, may well be objectionable from the standpoint of noise. The reason for this is that the fan speed and resulting air velocities through the wheel and housing that are necessary to develop the pressure — even at the point of maximum efficiency (minimum speed) — are too high for quiet operation without acoustical treatment, regardless of the fan blade shape.

● Fan noise is a major problem in air conditioning and other applications where low noise levels must be maintained. Some of the concepts of the causes of fan noise are inadequate. The consulting engineer, when designing these systems, must consider many factors—including sound pressure, energy content, blade frequency, and attenuation—in order to come up with the best balance between system efficiency and quiet operation.

Mr. Tracy graduated from Sheffield Scientific School, Yale University, in 1934. He has been associated with B. F. Sturtevant Co. and the later Sturtevant Div. of Westinghouse since that time, serving in various engineering capacities.

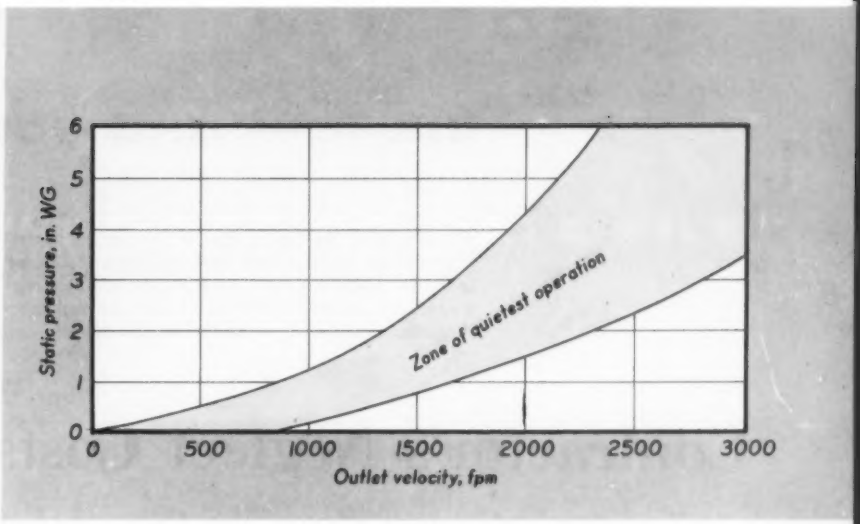
Noise Depends on Fan Speed, Air Velocity

For a given pressure, noise is dependent upon two quantities: the fan speed and the air velocity leaving the wheel. The pressure developed by a fan depends on the arithmetical products of these two quantities. This means that for a given pressure it is possible to have a low speed fan with a corresponding high air velocity or, conversely, a high speed fan and a low air velocity. In a low speed fan the noise can come from high air velocity.

In any event, the noise is proportional to the pressure developed. If the fan is a low speed, forward curved blade type or a higher speed, backward inclined *flat* blade type, the noise will be substantially the same for any given pressure.

Clayton H. Allen[1] states:

"Fan noise is primarily aerodynamic in origin and may be divided into two parts, a rotational component and a vortex component. The rotational component is associated



1 GRAPH may be used as guide for determining outlet velocity of any required static pressure to insure maximum efficiency, minimum noise

with impulses given to the air by the fan blades in passing a given point in the fan housing or support.

"The vortex component is principally due to the shedding of vortices from the trailing edge of the fan blades. It has a continuous spectrum throughout the audible range and may have many nonharmonic, single frequency components determined by the blade geometry and local air velocity."

A series of tests on centrifugal fans has shown that, for the same rated horsepower, two fans may be quite different in the amount of noise produced. In fact, fans with backward inclined blades often yield lower noise spectra than forward curved blade designs. The overall sound power level is related to the horsepower rating and efficiency of the fan.

Blade Frequency Concept Is False

The question of fan blade frequency often arises when selections are made for quietness of operation. It has been claimed that the greatest noise intensity occurs at the blade frequency (*rpm* × *number of blades*)/60. The greater the number of blades, the higher the frequency. Since high frequency noise is more easily attenuated, it would seem that a large number of blades is desirable. *This is not true.*

Contrary to common belief, a fan does not produce all of its noise at its fundamental rotational frequency. The rotational noise is combined with vortex noise, caused by the shedding of small vortices off the fan blades, to produce a frequency spectrum very broad in character containing acoustic energy from 20 to 10,000 cps. Regardless of fan type, blade shape, or number of blades, the highest noise level produced by a centrifugal fan will be in the low frequency range under 100 cps. Attention must be given to noise reduction throughout the entire frequency range. Acoustical duct treatment, when used to reduce fan noise, should always be designed for the low frequencies — *not* the easily attenuated higher blade frequency.

Noise level tests prove that all types of fans are quietest when operating in the vicinity of maximum efficiency. There are two reasons for this. First, at peak efficiency the fan is operating near the peak of its pressure curve and therefore the speed is lowest for a given pressure. Second, air turbulence is the lowest at maximum efficiency, thereby keeping turbulence noise to a minimum.

The common practice of specifying centrifugal fan outlet velocities which conform with accepted practice for duct velocities in air conditioning applications often results in poor selection from the standpoint of fan efficiency. Fan outlet velocity selections must be varied in relation to the static pressure requirement for the duct system in order to obtain optimum performance at maximum efficiency. Fig. 1 is a useful guide for determining outlet velocities for any required static pressure to insure operation at maximum efficiency and minimum noise.

Must Consider All Factors

Experience has shown that sound level "ratings" for fans are more confusing than they are useful — unless careful consideration is taken of all factors affecting the system.

The size, acoustic properties, and noise level of the space served and of the room in which the unit is located, all influence quietness. If the application demands that the unit be located close to the space served, consideration must be given to a number of factors such as the use of vibration dampeners, a properly selected motor, and the acoustical treatment of equipment room and air supply ducts.

Mechanical noise is also important. A proper foundation, even with vibration isolation, is imperative. Bearing noise at normal fan speeds is insignificant for all practical purposes and therefore antifriction bearings are preferred for ease of maintenance.

Fortunately, it is no longer necessary to rely on meager information and then "guesstimate" what should constitute a satisfactory noise level. Research has made available scientifically designed commercial sound attenuation devices, and also scientific proven data for their selection. ∔

[1] *Noise from Air Conditioning Fans*, by Clayton H. Allen, Noise Control, January 1957.

the law and your profits

WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background. This series presents actual cases. All names are, however, fictitious. It should, of course, be remembered that the law varies in different states.

Contractor's Neglect Costs Him Plenty

It is of supreme importance that building code ordinances be strictly adhered to. Should it be necessary to remove safety devices in the course of installation work, a man should be stationed to warn workmen until these devices can be repositioned. Where such devices have been removed or do not exist, troubles may arise, as we shall see here:

Vick Timm was an employee of Cumfort Co., heating, piping, and air conditioning contractor on a hospital job for which Les Kare Construction Corp. was general contractor. One day, while his helper, Hann Dee, was leveling some pipe along the first floor ceiling, Timm fell into an open unguarded shaft to the sub-basement —a drop of some 30 ft.

Badly injured, he sued the general contractor for $116,000 in damages, alleging negligence on his part.

In court Timm set forth the following facts: Hann Dee was on a scaffolding working overhead with the pipe. Timm was on the floor to the rear of the scaffolding and was directing Dee's movements. In order to get a proper perspective and determine whether the pipe was level, Timm walked backward away from the scaffolding, taking several steps. He repeated this movement a couple of times and in so doing backed into the open stairwell.

Timm claimed he was unfamiliar with the site of the job and did not know that an open shaft to the sub-basement was yawning behind him as he backed away from the scaffolding. He asserted that he was at all times acting with due care for his own safety, and that at the time and place he had no reason to suspect any danger.

The shaft at the first floor, from which he fell, had no guardrail or other protective device, nor did it have a staircase. However, stairs led from the sub-basement up to the basement. When Vic Timm fell, his left foot hit the bottom step of these stairs, his right foot striking a pipe laying on the sub-basement's concrete floor.

Les Kare Construction Co. had been negligent, Vick Timm averred and therefore was liable for heavy damages. He cited a city ordinance to the effect that "all floor openings, unless guarded by permanent enclosures or full height temporary barriers, shall be covered with substanial temporary flooring or be guarded on all sides by substantial railings not less than 3 ft high and set at a minimum of 2 ft from the edge of the opening, except for such parts of the openings as are necessarily open for traffic purposes."

Timm charged Les Kare with specific negligence (1) in allowing the shaft to remain open and unprotected; (2) in failing to cover the shaft or to place protective devices around the opening; (3) in failing to give any warning of the opening; and (4) in violating the city building code.

Defendant Les Kare filed a *general demurrer* to all these charges. The court thereupon dismissed the suit.

Vick Timm appealed. Reversing the trial court's decision, the state supreme court found in favor of plaintiff Timm. It held that the trial judge should not have dismissed Timm's suit, but should have permitted a jury to pass upon Les Kare's alleged negligence.

Said the higher tribunal, in part: ". . . the provision of the city code required the defendant to keep the open shaft closed, and the plaintiff had a right to rely on the defendant's obeying the mandate of the law."

In stating their decision favoring Timm, the court added: "We have also considered the allegation that the defendant construction company was inescapably aware that workmen often find it necessary to step backward in order to perform the duties of their employment."

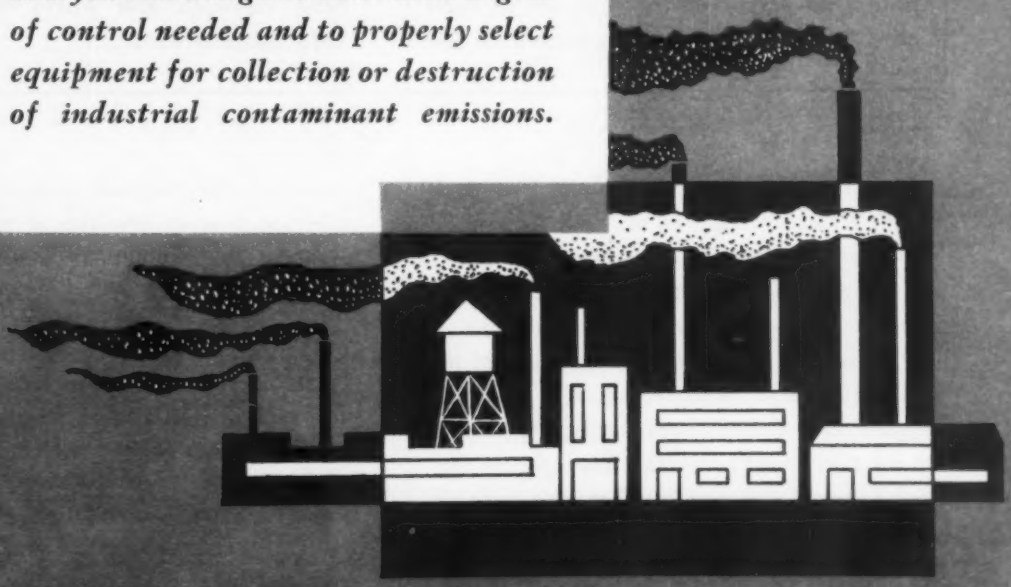
The possibility that plaintiff Timm was himself negligent likewise received serious consideration at the hands of the supreme court. It decided as follows: Timm's petition "alleged facts sufficient to present a jury question as to whether, under the circumstances, the plaintiff was negligent in failing to look behind him, and whether his negligence"—if any—"amounted to a failure to exercise ordinary care for his own safety.

"It is decided that if the plaintiff was negligent, the question then arises as to whether his negligence exceeded that of the defendant and as to whether the plaintiff, in the exercise of ordinary care, could have avoided" the general contractor's negligence "after it was or should have been discovered. Except in plain and indisputable cases, the questions as to negligence . . . are for the jury." ∓

HPAC ENGINEERING DATA FILE

Air Pollution Control Demands Engineering Analysis, Design

The unique and local nature of air pollution requires careful engineering analysis and design to determine degree of control needed and to properly select equipment for collection or destruction of industrial contaminant emissions.



Air Pollution Control Demands Engineering Analysis, Design

Air pollution means different things to different people living under different conditions. As J. H. Carter, smoke commissioner of the city of St. Louis puts it, the nature of the problem "depends upon where you stand". When standing downwind of a smoking stack, the problem is one of soiling, poor visibility and odor. In Los Angeles on a smoggy day, eye irritations and blurred visibility are the problem. Many factors acting simultaneously determine whether the dusts, fumes, gases and vapors emitted to the atmosphere become a pollution problem from the standpoint of annoyance or effect on individual health or both. The extent of the problem in each area and the potential for growth of the problem determine the efficiency of the equipment that must be used to clean the effluents of industrial processes. Of course, the specific effluents involved must also be considered.

Although the engineer may not be called upon to conduct an air pollution survey of an area, some knowledge of the effects of topography, meteorology, legal requirements, neighborhood requirements and types of contaminants involved is needed. This knowledge is necessary to properly assess air pollution surveys when they are available, and to establish the degree of control required in areas that have not been surveyed and where there are no legal requirements.

AN INFORMED and aroused public is often necessary to achieve passage of air pollution control legislation affecting the habits of both industry and the individual. But engineering methods and techniques — though seemingly slow at times — must be applied to evaluation and control of the problem to guide legislative effort so that it is adequate but not unnecessarily restrictive, effective but not economically unsound. Inadequately considered control measures could work a hardship on industry, the community, and the individual. For this reason, the considered judgment and action of every engineer as well as members of other professions involved in one of the many facets of air pollution and its control is essential to the solution of this growing problem.

The scope of the problem, in Los Angeles County in particular, is indicated by the many "firsts" recorded there in application of equipment for control of air pollution as listed in Table 1, which has been abstracted from the report (1)* of R. L. Chass presented at the recent National Conference on Air Pollution. While the many

*Numbers in parentheses refer to references at end of article.

TABLE 1—VARIETY OF EQUIPMENT applied to control industrial emissions in Los Angeles County
"firsts" indicates vast scope of air pollution problem and what solutions are being used

Date placed in operation	Equipment	Cost	Remarks
Jan. 1948	Exhaust system with baghouse serving brass melting crucible furnaces	$ 4,000	First brass furnaces of this type to be controlled.
Aug. 1949	Exhaust system and baghouse serving an electric steel melting furnace	2,500	First electric steel furnace ever to be controlled with a baghouse.
Feb. 1950	Afterburner serving a coffee roaster	1,800	First coffee roaster ever equipped with afterburner.
June 1950	Afterburner for a varnish cooking kettle	2,000	First direct fired afterburner and the first really satisfactory control device on a varnish kettle.
Aug. 1950	Exhaust system and electric precipitator with waste heat boiler serving an open hearth steel melting furnace	150,000	First open hearth furnace to have satisfactory air pollution control equipment.
Nov. 1950	Electric precipitator serving an aluminum dross recovery plant	30,000	First dross recovery plant ever controlled by a precipitator.
Dec. 1950	Chemical plant to recover elemental sulfur from refinery waste hydrogen sulfide	1,150,000	First chemical plant in Los Angeles County to recover waste hydrogen sulfide gas and convert to elemental sulfur.
Jan. 1951	Exhaust system, quencher and baghouse serving two iron melting cupola furnaces	15,000	First iron cupola ever to be satisfactorily controlled.
Feb. 1951	Baghouse serving a galvanizing kettle	1,000	First baghouse to serve a galvanizing installation.
May 1951	Water spray cooler and baghouse filter serving as asphalt roofing paper saturator	25,000	First baghouse ever to be used to control oil mists from an asphalt roofing paper saturator.
Jan. 1952	Electric precipitator serving an iron melting cupola	40,000	First electric precipitator ever used to control a gray iron melting cupola furnace.
Jan. 1952	Exhaust system with electric precipitator serving two 75-ton and one 50-ton electric steel melting furnaces	650,000	First satisfactory installation ever to control large electric steel melting furnaces.
Feb. 1952	Venturi-cyclone scrubber	25,000	First ceramic frit smelter to be controlled satisfactorily.
Apr. 1952	Exhaust system with afterburner and baghouse serving aluminum sweat furnace and a rotary aluminum chip dryer	6,000	First really satisfactory installation ever to control such nonferrous operations.
Feb. 1953	Water scrubber serving galvanizing kettles	12,000	First contral device capable of controlling odors and gases from a galvanizing operation.
Feb. 1953	Boiler firebox and crude oil absorber serving refinery waste water system	340,000	First controls for a refinery waste water system in which separator is covered and collected gases are absorbed and incinerated.
June 1953	Water scrubber coupled with electric precipitator for controlling fumes from fluxing of aluminum in a reverberatory furnace	45,000	First such control system ever installed for the combined problem of fluoride and chloride fluxing fumes.
July 1953	Electrostatic precipitator serving an asphalt roofing paper saturator	40,000	First two-stage electrostatic precipitator ever installed to control a roofing paper saturator.
Nov. 1953	Water scrubber for control of fumes from airblown asphalt manufacture	45,000	First installation ever to use a sea water scrubber.
Nov. 1953	Sour water oxidizer to convert odorous sulfides into water-soluble thiosulfates	$ 30,000	First installation for disposal of sulfides in effluent water as contrasted to standard method of burning to sulfur dioxide.
Dec. 1954	Absorber units employing gasoline as the absorbing medium for recovery of vapors collected from bulk loading of tank trucks	40,000	First installation of its type ever to be designed and installed.
Jan. 1956	Vapor collection system for gasoline loading rack at refinery	30,000	First vapor collection system to collect escaping vapors released in bulk loading of tanker trucks.
April 1956	Flue gas heater serving a fluid catalytic cracking unit	80,000	First installation to prevent formation of sulfur trioxide and resulting plume.
April 1956	Direct flame afterburner on a paint bake oven	5,000	First paint bake oven equipped with a direct flame afterburner to control emissions.
April 1956	Direct flame afterburner serving meat smokehouse	4,000	First direct flame afterburner ever installed on a meat smokehouse.
Oct. 1956	Baghouse with radiant cooling ducts on glass furnace	8,500	First installation of control system on glass furnace.
Nov. 1956	Scrubber coupled with an electrostatic precipitator serving meat smokehouses	10,000	First such control device ever installed to control smoke from smokehouses.
Mar. 1957	System for control of discharge from coker unit blowdown, consisting of water scrubber, condensers and final discharge to refinery flare	385,000	First system for control of hydrocarbons from coker unit blowdown.
Oct. 1957	Exhaust system with baghouse serving four stereotype metal melting pots	9,000	First such controls ever installed at a printing establishment.
Jan. 1958	Direct fired afterburner serving plastic curing oven	2,800	First afterburner ever installed to control the discharge from a plastisol curing oven.
Feb. 1958	Activated carbon adsorber installed to control solvent losses from dry cleaning plant	4,000	First such installation for this type cleaning plant.
Mar. 1958	Direct fired afterburner on a large paint baking oven	16,000	First installation of its kind on an automobile bake oven.
Mar. 1958	Activated carbon vapor adsorber on a five color rotogravure printing press	48,000	First regenerative activated carbon adsorber unit serving rotogravure press and which was installed strictly for air pollution control purposes.
Mar. 1958	Activated carbon adsorber serving 47 paint mixing tanks	10,000	First such installation made at an automobile manufacturing plant for the purpose of controlling solvents.
Apr. 1958	Catalytic afterburner on paint bake oven in an automobile assembly plant	70,000	First catalytic afterburner installed to control paint baking oven in an automobile assembly plant.
To be completed in 1959	Electric precipitator serving a 1,254,000 lb per hr oil burning steam generator	1,000,000	First oil burning steam generator to be equipped with an air pollution control device other than controls for soot blowing.

Abstracted from "Extent to Which Control Techniques Have Been Utilized in Los Angeles County" in paper by R. L. Chass (1).

different industrial sources of pollutants may not all be present in other communities, in many cities one or more may be present and may require similar control. It is evident that heating, piping, and air conditioning engineers and contractors are responsible for proper design, installation operation, and maintenance of much of this equipment.

The engineer's responsibility in conserving the air we breathe was stated (2) by the Engineers Joint Council recently as follows:

"Engineering involves directing the forces of nature and the activities of man to his own use, convenience and welfare. In view of air pollution's causes and effects, and the technical nature of its control, the engineering profession is qualified and duty bound to contribute substantially to the control of air pollution.

"Engineers are involved, through research, development, design, construction, installation, operation, and maintenance, in activities that bring into being man-made sources of air pollution. Engineers have already made substantial contributions to the solution of air pollution problems by application of technical knowledge. Many of these contributions have resulted from efforts to utilize fuels and raw materials more effectively, while others have come from efforts specifically directed to minimizing air pollution nuisances and hazards."

The extent to which the amount of wastes discharged to the atmosphere must be controlled is a local or regional problem depending upon many factors, including population and industrial density, topography, and micro-meteorology. The choice and extent of control measures are engineering decisions and many of the variables or parameters are well known.

Although much knowledge exists for proper control, the discussion group concerned with control methods at the recent National Conference on Air Pollution acknowledged that more effective use of available information could be made. Charles W. Gruber, air pollution control and heating engineer of the City of Cincinnati, is in agreement with this and notes that there is a great deal of misapplication of air cleaning equipment. He attributes this to lack of standards for testing air cleaning equipment, lack of real understanding of the problem, and lack of understanding of the degree to which effluents must be cleaned to satisfy either legal or neighborhood requirements.

Pollution Grows With Population

Coincident with the steady and rapid population growth, there occurs increased industrial activity and increased use of fuels for space heating, power generation, transportation, and manufacturing processes. These, and other activities related to improving the standard of living, release small (relatively) amounts of contaminants which, upon accumulation and interaction in the atmosphere, cause air pollution. This is especially true in metropolitan areas.

In the past, air pollution was looked upon as a local problem peculiar to large population centers having high industrial densities. People living outside these areas were not concerned with air pollution and those living inside such areas tolerated air pollution as a necessary evil. Presently, the concern about air pollution is more general because the problem itself is more general. In a recent interview, Dr. Mark D. Hollis, U. S. Assistant Surgeon General, estimated that some 10,000 cities in the United States have an air pollution problem. Or as Dr. Rex H. Wilson, medical director, B. F. Goodrich Co. states it, "It is no longer news that man-made smog can be constantly annoying and occasionally lethal. The fact that every large city in the world may be plagued with these conditions in the future creates a problem for the physician as well as for air pollution control scientists." Thus, air pollution is becoming general and it may be expected to increase as the population grows, for research has shown a strong relationship between air pollution and population.

Public awareness of air pollution and of its potential effects on health are increasing, as indicated by many mayors at the American Municipal Congress requesting an enlarged federal program for air pollution control research and assistance. Public interest may be expected to increase pressure for legislation against emission of wastes to the atmosphere and to increase the need for adequate control of industrial effluents. Typical is the adoption last December of an air pollution control ordinance by the city of Chicago, which

replaces a smoke abatement ordinance. Although no apparent health hazards have occurred in Chicago as a result of air pollution, cognizance of the potential hazard and the present costs of soiling and damage of buildings and personal property prompted this new ordinance. Many other places such as St. Louis, Pittsburgh, and Los Angeles County have enacted air pollution legislation. State level legislation has also been passed by a number of states to initiate or strengthen air pollution control.

Tangible evidence of success of the Pittsburgh and St. Louis air pollution control programs may be found in the dramatic reduction of smoke and heavy dustfall, which were considered the major air pollution problem when these measures were enacted. The success of the St. Louis program and the many ramifications and considerations in preparation of the program were discussed in Heating, Piping & Air Conditioning (3) by Raymond R. Tucker, formerly professor of mechanical engineering and head of department, Washington University, St. Louis and now Mayor of St. Louis. Mayor Tucker was intimately concerned with the preparation and enforcement of the program.

What Are Contaminants and Their Effects?

The contaminants in polluted air are gases, vapors, and particulate matter, or aerosols. In his paper (4) at the National Conference on Air Pollution, A. H. Rose, Jr., chief of engineering research and development of the air pollution engineering program at the Robert A. Taft Sanitary Engineering Center, Cincinnati, indicated that the gaseous contaminants in polluted air are believed to be significant in relation to health, property damage, plant damage, and nuisances. Aerosols or particulate matter, he noted, are considered to be of major significance in effects on visibility, corrosion, soiling and damage of property, and injury to animals, and of lesser significance in relation to health and plant damage.

The gases and vapors are emitted by combustion processes, both internal and external, chemical and industrial processes, and other similar sources. The composition of the gases and vapors varies with the process and may include sulfur dioxide, nitrogen oxides, hydrocarbon vapors, ozone, and others. Very limited data are available giving concentrations of the various gases and vapors of concern in air pollution control. According to S. Smith Griswold, Los Angeles County air pollution control officer, "future air pollution control will exert its greatest efforts against the various gaseous and partially oxidized organic air contaminants — gasoline vapors, solvents, thinners, bake oven exhausts, and the like. This does not mean, however," he adds, "that other gaseous materials, dusts, fumes, mists, smoke, and odors will be neglected." He assumes "that the objectionable qualities of this latter group are so well recognized that whenever they become a problem in a given location, regulation will follow as a natural result."

The particulate matter — which consists of smoke, fumes, dusts, and liquids — arises from combustion processes, mechanical action, and chemical reaction. A physical conception of particle size that must be considered in this is shown in Tables 2 and 3, prepared by C. E. Lapple (5). Table 2 gives the approximate sizes of some common particulates. The size of natural and process dusts varies a great deal with the specific conditions involved in their formation. The particle size of fumes depends to a large extent on their age, due to flocculating tendency. Consequently, the values given in Table 2 should be regarded only as average "order of magnitude" quantities, and wide variations from these values are possible. The values shown in Table 3 relate particle size to some common physical properties.

Particulate matter may be further divided into two classifications. These are large particles, which settle rapidly from the air; and small

particles, which remain suspended in the air. The amount of suspended particulate matter in a 50 ft layer of air covering one square mile is indicated in Table 4 for a number of cities. Values range from 7.92 lb per sq mile 50 ft deep to 20.71 lb. Data was selected at random from a recent report (6) of measurements taken by the National Air Sampling Network, which is composed of 180 city and 51 non-urban sampling stations. It should be noted that values given in the table are for a single sampling station in each city and represent averages over periods ranging from 1 to 5 years.

To illustrate possible deviation of amounts of particulate matter in each city consider Philadelphia, for example. For seven sampling stations reporting, the minimum reported value was 12.0 lb in a 50 ft layer covering 1 sq mile and the maximum was 33.9 lb. By the sampling method used, suspended particulate matter includes all particles (liquids and solids) less than 100 microns in diam and greater than 0.3 microns. One micron is 1/25,000 of an inch. The particulate matter indicated in Table 4 is that which remains airborne, to be dispersed, to react with one another and to be breathed by human beings. These particles may be of more importance than the larger particles because of their effect on individual health, injury to animals, and because of the compounds formed by the reactions which take place in the atmosphere.

The suspended particulate matter measured by the National Air Sampling Network includes both solid particles and liquid droplets. Chemical analysis of samples reveals the following pollutants:

1) *Organic* — This particulate matter is soluble in solvents such as benzene and acetone. Many different organic compounds are end products of incomplete combustion of hydrocarbon fuels. Some of these cause irritation of animal tissue. Some, such as benzpyrene, have been found to cause cancer. Organic particulates may also arise from natural causes, such as wind erosion of vegetation.

2) *Chlorides* — Many of these compounds are waste or byproducts of synthetic chemical production. In coastal areas, sodium chloride is present, in part from natural sources. Chloride pollutants contribute corrosive characteristics to the atmosphere.

TABLE 2—APPROXIMATE PARTICLE sizes of some common dusts

Dust	Approximate particle diameter, microns
Alkali fume	1-5
Ammonium chloride fume	0.1-1
Atmospheric dust	0.5
Atmospheric fog	2-15
Cement dust	40
Coal dust	5-10
Condensed zinc dust	2
Flour mill dust	15
Pigments	0.2-2
Smelter dust	0.1.100
Silica dust	1-10
Sprayed zinc dust	15
Sulfuric acid mist	1-15
Tobacco smoke	0.2
Talc	10
Zinc oxide fume	0.05

Data from "Mist and Dust Collection in Industry and Buildings", by C. E. Lapple (5).

TABLE 3—APPROXIMATE DIMENSIONS of some common items

Item	Dimension, microns
Limit of visibility with naked eye:	
Absolute limit	10
Probable limit	40
Diameter of large molecules	0.005
Wave length of visible spectrum:	
Violet light	0.4
Red light	0.7
Wave length of x rays	0.01-0.001
Diameter of human hair	50-200

Data from "Mist and Dust Collection in Industry and Buildings", by C. E. Lapple (5).

TABLE 4—SUSPENDED PARTICULATE MATTER for several selected cities shown here

City	Concentration, lb per sq mile, 50 ft deep layer of air
Atlanta	11.74
Boston	12.18
Buffalo	19.14
Chattanooga	15.14
Chicago	20.36
Cleveland	16.09
Detroit	18.71
Ft. Worth	13.31
Houston	11.83
Los Angeles	20.71
Louisville	14.44
New York	17.23
Philadelphia	19.75
Pittsburgh	13.05
Portland	12.27
Salt Lake	13.31
St. Louis	18.96
Tampa	7.92

Data calculated from Air Pollution Measurements of the National Air Sampling Network (1953-57), *U. S. Public Health Service* (6)

3) *Fluorides* — These have serious effects on both plants and animals. They may be introduced into the atmosphere by fertilizer, aluminum, steel, and ceramic industries.

4) *Sulfates* — Result from industrial processes and atmospheric reactions converting SO_2 of combustion end products to sulfuric acid which then reacts with other substances. Sulfates are generally corrosive. Some evidence exists that sulfur dioxide may enhance other reactions causing harmful pollution, in addition to its effect on plants and respiratory functions of animals.

5) *Nitrates* — Arise from similar sources as sulfates and in the same manner. Oxides of nitrogen are more harmful to health than to vegetation. Nitric oxide and nitrogen peroxide are absorbed by the blood stream in the lungs with a result comparable to that of carbon monoxide. Another N-oxide, nitrogen dioxide, is an important constituent in the photochemical formation of ozone in the presence of hydrocarbons. This reaction, which occurs in the Los Angeles (7) type of pollution, was discovered by A. J. Haagen-Smit. Nitrogen oxides are also end products of combustion.

6) *Metals* — Metals and their oxides may be contributed by industrial processes and urban activities. Measureable or trace quantities of such metals as zinc, copper, lead, chrome, iron, nickel, and others have been collected. Identification of metals can be used to pinpoint sources of pollution. The toxic concentration of many metals is known which permits definition of problem areas.

7) *Radioactive materials* — More public concern has been expressed over this pollutant than others present in much larger and, perhaps, more harmful quantities. Due to sensitive methods of measurement, radioactive materials may be detected from distant as well as local sources. Radioactive materials may originate from atomic power plants and manufacture of radioactive chemicals. Local exhaust systems may discharge the particles to the atmosphere unless they are properly filtered.

Settleable particulate matter is also of importance because of the effects on soiling, plant damage, and creation of localized nuisances. Recorded measurements (8) of particulate deposition rates in one county for areas of various character are given in Table 5. A large amount of solid material, varying from 17 to 64 tons per sq mile, is deposited each month on the average in this community. The particulate deposition rates for the industrial zone are two to three times those in residential and local business zones which immediately indicates the greater stack emissions in the industrial zone.

TABLE 5—AVERAGE PARTICULATE DEPOSITION rates in Milwaukee County are shown here for seven year period from 1951 to 1957, tons per sq mile per month

Agricultural Zone (4 sites)	17.0
Residential Zone (19 sites)	23.1
Local Business Zone (11 sites)	32.7
Commercial and Light Mfg Zone (2 sites)	48.2
Industrial Zone (15 sites)	63.6

Adapted from *"Air Pollution and the Gas Industry", by F. R. Rehm* (8)

Trends of the data presented (8) by F. R. Rehm indicate local progress in reducing particulate deposition rates. From 1951 to 1957 particulate deposition rates in the industrial zone decreased from 82 to 56 tons per month per sq mile. During the same period, no significant change in the trends in other zones is indicated by the data. This suggests that the larger settleable particulates, because of rapid fallout, create nuisances in the vicinity of the source.

An example of the effect of a single large industry on deposition of particulates in a rural area was illustrated by H. G. Bourne (9) in Heating, Piping & Air Conditioning, March 1958. An air pollution survey of the community, prompted by complaints of alleged air pollution by the citizens, indicated average dust falls in the vicinity of the plant of the order of 95 tons per sq mile per month. At distances about one mile to the predominantly downwind side of the plant, dust fall amounted to about 38 tons per sq mile per month. Further evidence of the contribution of this industry to local pollution was found in the composition of the dust fall. At 12 dust fall stations in the locality of the plant, which produced ferromanganese and ferrosilicon alloys, the average fall of manganese was 1.0 ton per sq mile per month and that of silica was 3.0 tons per sq mile per month.

Physical Signs of Pollution Disturbing

The common complaints of persons exposed to contaminated air are those associated with the physical evidence of air pollution. These include objections to smoke and poor visibility, unpleasant and noxious odors, eye irritations, difficult breathing due to effects on respiratory organs, the effects on plant life, and soiling and deterioration of the exterior surfaces of buildings. There is also general public concern that pollutants may induce cancer. Some of these complaints may be more prevalent in one area than another because of variations in the nature of pollutants.

For example, in the case of the Los Angeles type of pollution, eye irritations, blurred visibility, plant damage, and effects on respiratory functions are most frequent complaints. The conditions necessary to produce this pollution are mainly found in west coast regions. They are largely due to high concentrations of automotive exhausts and photo chemical reaction (10) of the various pollutants.

Effect on Health Is of Great Concern

The potential physiological effects of air pollution are of great concern to industrial hygienists and public health officials. This was made evident in Dr. Leroy Burney's opening address (11) and the recommendations of the discussion group concerned with health effects of pollution at the recent National Conference on Air Pollution.

Dr. Burney said: "We need not look for nationwide epidemics from air pollution. We *have* been alerted by severe outbreaks both within industrial establishments and in community-wide smogs under certain atmospheric conditions. And now, after several years of closer observation, investigators are finding a definite association between community air pollution and high mortality rates due to cancer of the respiratory tract, including the lung, cancer of the stomach and esophagus, and arteriosclerotic heart disease."

The long term effect of uncontrolled air pollution on chronic diseases and ailments that may be caused or aggravated by long time and repeated exposure to low concentrations of contaminants is being given much attention. The relationships between the various pollutants and many chronic ailments have not yet been established.

One group considering health effects of air pollution recently recommended that nuisance due to air pollution be regarded as a public health problem. This was based upon the premise that the nuisance effects, poor visibility, odors, etc., influence efficiency and emotional and physical comfort and well being. It was felt that these effects need not necessarily be manifestations of specific disease entities.

In the case of acute air pollution such as that which occurred at Donora, Pa. in 1948, the effects are well documented. Due to unusually heavy concentrations of sulfur dioxide and other chemicals, many deaths occurred that were attributed to pollution. It should be noted that unusual local weather conditions contributed to the severity of the problem. Dr. Burney stated that a recent study of the Donora population shows that persons made ill in 1948 have had poorer health and higher mortality rates even though air pollution has been reduced.

Though the effects of pollution on health have not been elucidated, the available evidence indicates that *uncontrolled* pollution cannot continue without adverse effects on public health. The Conference participants recommended that control efforts be intensified even though the answers to many of the medical problems involved were not available. At the same time, they agreed that it was imperative that such answers be found at the earliest possible time to guide the development and design of control programs. To this end laboratory and field investigations are continuing in order to establish the allowable concentrations of pollutants that are necessary for adequate and economic control.

Sources of Pollutants Are Many

The sources of air pollutants in a community may be many and varied. They may be due to natural phenomena, such as dust storms, as well as to domestic, industrial, and municipal activities. Some of the industrial sources of air pollution include:

1) The products of combustion from heat and

power producing equipment. The pollutants vary with the fuel, and burning some fuels produces more pollutants than others. Soot, smoke, fly ash, fumes, sulfur dioxide, nitrogen oxides, carbon dioxide, and carbon monoxide are some of the end products of combustion that may contribute to air pollution.

2) Industrial processes for petroleum refining, chemical, metallurgical, and ceramic operations and many others may contribute compounds peculiar to the specific industry involved. These pollutants may be discharged with stack gases or may be discharged by exhaust systems used to minimize internal pollution for health and safety of the workers.

The domestic and municipal sources of pollutants include combustion processes for space heating and incineration, and internal combustion engine exhaust. Many of the same compounds originating from industrial processes are generated by municipal sources.

While it is known that most industrial processes cause some amount of pollution, total knowledge of the identity and concentrations of pollutants is very limited. Identification of many primary pollutants is made difficult by the many complex chemical reactions which take place in the atmosphere. For this reason, it is not always possible to isolate the sources by measurement and analysis.

The relative contributions of industry and municipalities to the pollution problem, though difficult if not impossible to measure, vary according to the nature of the community. In some communities, such as that surveyed by H. G. Bourne, Jr., (9) industry may be entirely responsible for aggravating air pollution. This is especially true when considering the local nuisance type of pollution.

TABLE 6—RELATIVE CONTRIBUTIONS of three major categories of sources in Louisville

Source	Contaminants, percent of total		
	Gaseous	Solids	Total
Domestic heating (space heating, hot water heating and cooking)	6	3	9
Transportation (autos, trucks, trains, and busses)	6	0.1	6
Industry	78	7	85
Totals	90	10	100

From "The Air Over Louisville" (12)

Industry Not Always Major Source

One of the most complete surveys of sources and their contributions to community air pollution has recently been reported (12) for the western portion of the Louisville metropolitan area, which includes portions of both the city of Louisville and contiguous area of Jefferson County, Ky. A summary of the relative contributions of three major sources in this area is given in Table 6.

The area surveyed was selected on the basis of the major industrial sources in Jefferson County and the portion of Louisville most affected by these sources. As in the area surveyed by Bourne, industry contributes the major portion of the air contaminants. However, in considering the greater Louisville metropolitan area, domestic and transportation contributions would exert a more substantial effect on atmospheric pollution than is indicated in the table. The total daily emission of gaseous and solid contaminants amounts to about 440 tons. It is interesting to note that 54 percent of the airborne solids in the industrial area of Louisville result from the burning of fuel for power, heat and light.

Although in the two examples cited industry was the major source of air pollution, in other communities the summation of the contributions of individuals may exceed a relatively large industrial contribution.

Status of the Los Angeles problem is indicative of this fact. Even though industry has spent millions of dollars to clean stack effluents, the pollution problem continues primarily because of individual contributions through the use of automobiles (10). However, since we can no longer look upon air as an unlimited resource, every effort must be made to control the type and amounts of pollutants discharged by both industrial and municipal sources.

What Are Factors in Air Pollution Control?

The complexity of the air pollution problem demands a thorough study before applying existing techniques of control. As stated (4) by A. H. Rose, "The engineering approach to air pollution control is, therefore, to limit at the source the amount of pollutants discharged to the atmosphere such that the concentration of these pollutants in the environment from all sources will be sufficiently low to prevent detriment to health and property or the occurrence of nuisances, but at the same time allow the atmosphere to function usefully in its capacity as an acceptor of emitted wastes." He noted that data regarding the character of contaminants and adequate control methods are available for many operations, but in the case of new operations, engineering studies are necessary to determine the operating characteristics of the system. These studies "generally include all or part of (1) review of available source data, (2) some sampling and laboratory analysis to obtain contaminant characteristics, (3) calculations to establish the control requirements, and (4) pilot plant work to develop the required control, if such is indicated."

Although many phases of the engineering studies may require the services of a specialist in air pollution measurements and computations, it is essential for all engineers involved in air pollution control to be familiar with the many facets of the problem. It is only through proper interpretation of results that satisfactory and economical control will be effected.

Observe Six Main Points

The decision to apply available methods of air cleaning to abate air pollution depends upon many factors. Some of these are:

1) *Topography* — The ability of the atmosphere to disperse pollutants depends upon local topographical (13) features. Such things as nature of ground cover, variations in elevation, locations of bodies of water and other features affect local air movement and the type or extent of control measures needed. This is an important consideration in the selection of new plant sites and determination of the need for stack gas cleaning.

2) *Meteorology* — Local weather analyses including wind velocities and directions, temperature gradients and other weather effects are important (14) in control of air pollution. Amount of stack gas cleaning required will depend on ability of air to disperse contaminants thereby diluting them to allowable concentrations. Knowledge of macro (regional) and micro (plant area) meteorology is also necessary to determine the necessary stack height for a particular emission. Meteorology is also important in the selection of new plant sites and determining the need for stack gas cleaning.

3) *Contaminants emitted* — The character and amount of contaminants to be disposed of must be considered. Toxic discharges must be treated differently than emissions causing only nuisances. In existing installations experimental sampling techniques may be employed to obtain necessary contaminant characteristics.

4) *Legal requirements* — Local codes may impose restrictions on stack dust loading and emission concentrations that make stack gas cleaning mandatory.

5) *Neighborhood requirements* — These establish the degree of cleaning necessary beyond specific legal requirements. In neighborhoods not previously subjected to industrial emissions, odors, etc., a relatively higher degree of cleaning will usually be required for good public relations than would be required in an area adjacent to an industrial complex. Anticipated industrial and population growth should also be considered.

6) *Comparative costs of installation of equipment at present and in future* — Although cleaning equipment may not be necessary at the time an industrial plant is erected, the growth character-

istics of the location may indicate that control will become necessary. In many cases, installation of equipment for control during construction will be sufficiently less expensive to justify its incorporation in the original design. At the recent National Conference on Air Pollution, the discussion group concerned with control methods recommended that "properly designed and engineered control equipment should be incorporated in the initial plant specifications."

What Is Effect of Meteorology?

The diffusion — or lack of diffusion — of contaminants discharged to the atmosphere determines, in most cases, the degree of air pollution and nuisance caused by a particular source. If atmospheric conditions are such that the contaminants do not disperse, the concentrations may rise to levels which are injurious to health as well as causing damage to physical property. In general, the ability of the atmosphere to disperse the wastes emitted will determine the degree of stack gas cleaning required. Thus, some knowledge of meteorological phenomena is essential to good engineering design of control systems.

In his paper presented (15) at the National Conference on Air Pollution, Dr. E. W. Hewson, professor of meteorology, University of Michigan, noted that "mixing is the primary diffusing agency in the atmosphere. The diffusion due to mixing," he said, "is of the order of one thousand to one million times greater than the effect of molecular diffusion alone." The mechanisms causing mixing are mechanical turbulence due to wind flow and thermal turbulence associated with a rapid rate of decrease of temperature with height.

In general, mechanical turbulence or that caused by wind occurs in a horizontal layer within a few hundred feet of the earth's surface. (Fig. 1) However, topography or man-made obstructions increase this turbulence, thereby causing greater mixing. Turbulent fluctuations of wind velocity and wind direction both affect the mixing and dilution of contaminants in the atmosphere.

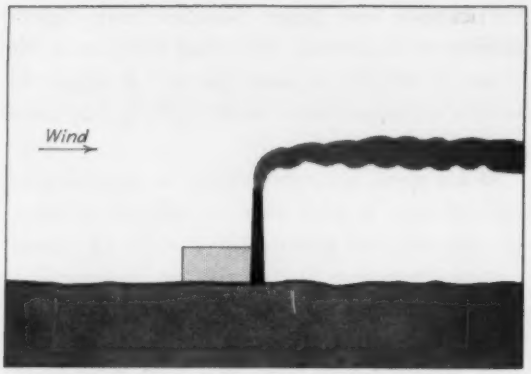
In addition to its effect on turbulence, wind has other influences on the pollution problem. Wind direction determines the way in which the contaminated air will travel and wind speed affects the distance that larger particles travel before settling to the surface. The wind direction at the point of emission is important and it should be noted that ground level wind direction may differ from that at a stack outlet.

Wind speed has other effects on dispersion of contaminants in addition to its relation to turbulent mixing. The primary effect is that of ventilation or dilution of stack emissions. In general, it may be assumed that dilution is proportional to wind speed. Thus, if a stack discharges at a constant volume rate of flow, for a given wind speed, some level of concentration of contaminants will exist downwind. If the wind speed is double, the concentration will be reduced to one-half. Surveys of a plant site to obtain wind speed frequencies are, therefore, important in determining concentrations of contaminants that may be emitted.

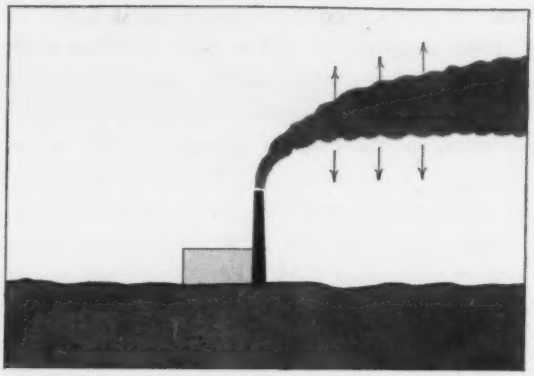
High wind speed may also cause contaminants to be carried to the ground in the vicinity of a stack. According to Dr. Hewson, a characteristic wind speed of 15 to 20 mph may cause aerodynamic downwash.

Thermal turbulence results from vertical temperature variations near the surface and is primarily responsible for vertical mixing or diffusion of contaminants (Fig. 2). Rapid dilution of contaminants occurs by thermal turbulence, but in extremely unstable conditions some contaminants may be carried to the surface near a source.

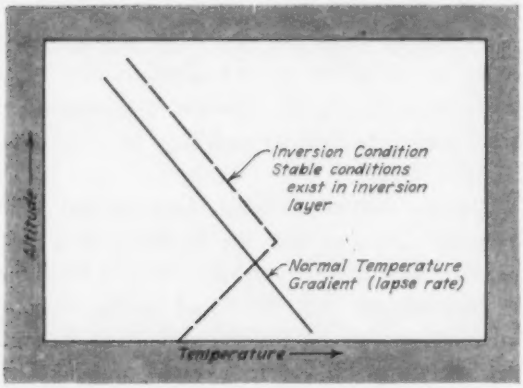
The normal vertical temperature variation (lapse rate) is such that temperature decreases with altitude, as shown in Fig. 3. When the situation reverses near the ground, temperature increases with altitude, an inversion (as it is called) exists and the atmosphere becomes stable. The Los Angeles pollution problem is aggravated by inversion conditions. When these conditions persist, very little vertical diffusion of stack gases occurs and contaminant concentrations may increase to harmful levels. In addition, inversion conditions are usually accompanied by light winds which tend to minimize mechanical turbulence. Inversion conditions occur most frequently when the earth is cold relative to the air—so they most often occur at night and also during the winter months. Thus, the effect of inversions is made more severe because they occur at times when contaminants contributed by space heating may be a maximum.



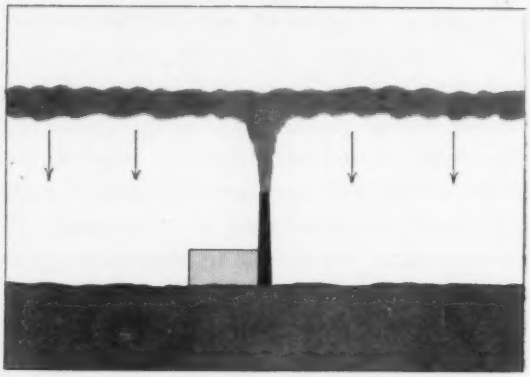
1 WIND CAUSES HORIZONTAL DIFFUSION of contaminants through dilution although some vertical mixing may occur due to effects of surroundings on mechanical turbulence created by wind



2 THERMAL TURBULENCE caused by vertical temperature gradients results in vertical diffusion of contaminants. Combined forces of wind and temperature usually act to disperse contaminants



3 NORMAL VERTICAL TEMPERATURE GRADIENT is such that air temperature decreases with increase in altitude. Under inversion conditions temperature in shallow layer increases with altitude and little vertical mixing occurs



4 CHANGING FROM AN INVERSION condition to normal temperature gradient may cause accumulated contaminants to descend to ground causing high concentrations at surface for a short period of time

Another aspect of inversions that should be considered is the possibility of high concentrations occurring at ground level when the inversion condition is broken and the atmosphere becomes unstable (Fig. 4). The contaminants collected in the upper level of the inversion layer may diffuse to the surface as the ground is heated by the sun and thermal turbulence grows upward to the layer of the contaminants aloft.

Reduction of contaminant concentrations by atmospheric precipitation is also an important weather effect in the overall air pollution problem. Removal of contaminants in this manner may result from rain droplets forming about the contaminant particles serving as condensation nuclei and by simple entrainment of particles during rain and snow falls. It is not possible to predict, within the limits of existing knowledge, the effect of such precipitation of contaminants on the pollution problem.

Wise management of the atmosphere as a great natural resource requires further use of the practice, where possible, of varying contaminant output from a plant in accordance with the capacity of the atmosphere to accept wastes safely. This means discharging a maximum of pollutants when dispersion is good and a minimum when dispersion is poor. In one acute situation (16) plant operation was sufficiently flexible to permit varying the output of SO_2 from the stacks in accordance

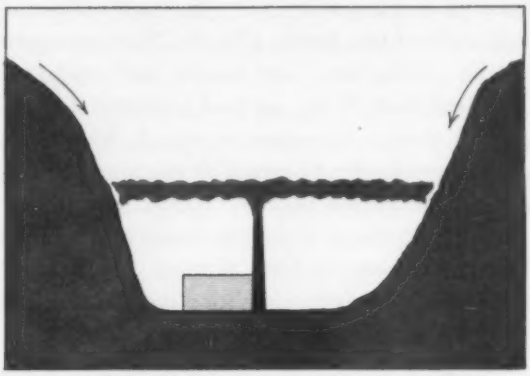
with an operating regime based primarily on measured values of atmospheric turbulence, wind direction, and wind speed. Low sulfur coal may be used during protracted periods of poor diffusion. If processes in new plants were designed for maximum flexibility in operation, a wider and beneficial use of this principle of meteorological control of industrial sources of air pollution could be made (17).

It is evident from the foregoing that weather has an important influence on industrial air pollution. For example, Dr. Hewson states that under high turbulence conditions the concentration of contaminants downwind from the source may be as low as one part per million. On the other hand, under low turbulence conditions, inversion, low wind speed, etc., the concentrations downwind from the same source may be as high as one thousand parts per million. This further emphasizes the need for wise use of the atmosphere as an "acceptor of wastes."

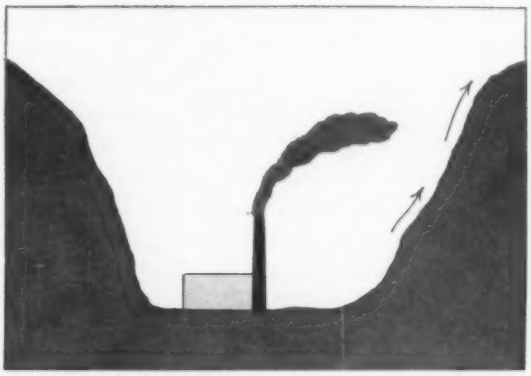
Topography Also Important

Topography has an effect on air pollution that is primarily a function of its effect on local meteorology. The degree of roughness of the terrain affects mechanical turbulence, as indicated earlier. Small variations in elevation—such as surface roughness in apparently level terrain—affect gustiness or local vertical variations of wind and temperature. Sharp changes in elevation cause considerable vertical turbulence and may also provide a physical barrier to dispersal of contaminants. In deep valleys, for example, horizontal dispersion of contaminants is sharply limited by the valley sides. The stack gases drift up and down the valley and collect to undesirable concentrations. Fortunately, some vertical diffusion occurs due to thermal turbulence.

The effects of hills and valleys are more pronounced because of their influence on thermal circulations of the atmosphere. Local cooling of air at the top of a valley causes mountain breezes which descend to the valley floor (Fig. 5). Conditions for the mountain breeze usually occur at night. The mountain or descending breeze tends to hold contaminants in a shallow layer near the valley floor, thus increasing the need for adequate stack gas cleaning. During the daytime, local



5 MOUNTAIN BREEZES caused by local cooling descend into valleys, usually during the late evening hours, when air at rim of valley is cooler than that at the same height in center of valley. This tends to concentrate pollutants in layer above the valley floor



6 VALLEY BREEZES caused by local warming ascend valley walls, usually during periods of high solar radiation. Initial change from mountain to valley breezes may cause high concentrations to descend to valley floor for a short period of time

warming of the valley floor and slopes by solar radiation causes air to ascend from the valley (Fig. 6). The valley breeze tends to disperse pollutants as it provides vertical mixing. At the outset of the valley breeze, non-uniform heating of the valley surfaces may cause a downward flow of contaminants accumulated during the preceding night (16). This action may result in more acute pollution at the surface than that due simply to the accumulation during the late evening hours. However, pollution of this type is rather short lived and proper control of the industrial processes involved can eliminate the problem.

Another thermal circulation that affects diffu-

sion of contaminants is the land and sea breeze or land and lake breeze (Fig. 7). This movement of air results from local heating and cooling of adjacent areas. When the land is warmer than the water, the air movement is inland. Sea breezes have been known to extend as much as 30 miles inland. When the water is warmer than the adjacent land, the air flow reverses and contaminants are carried over the body of water. The effect of this circulation is to complicate the diffusion and dispersion patterns.

What About Pollution Climatology?

Although topography and meteorology have been considered separately above, it is evident that they are interrelated since topography is important because of its effect on atmospheric air movements. The evaluation of the climate of a new site to determine the need for air pollution control equipment or to select plant location must consider both factors. While the engineer selecting control equipment may not have to conduct the necessary air pollution survey to determine the regional and micro climate of a new site, he should be familiar with the climatic factors involved. He is responsible for control equipment and if, because of an inadequate survey, air pollution results, the equipment design and adequacy will be questioned. Thus, the various effects of meteorology must be known to properly assess surveys on which designs are to be based and to determine whether the site survey would be advantageous for economic design of control equipment for an existing installation presumed to be causing air pollution.

Other information (14) that should be collected in an adequate site survey includes:

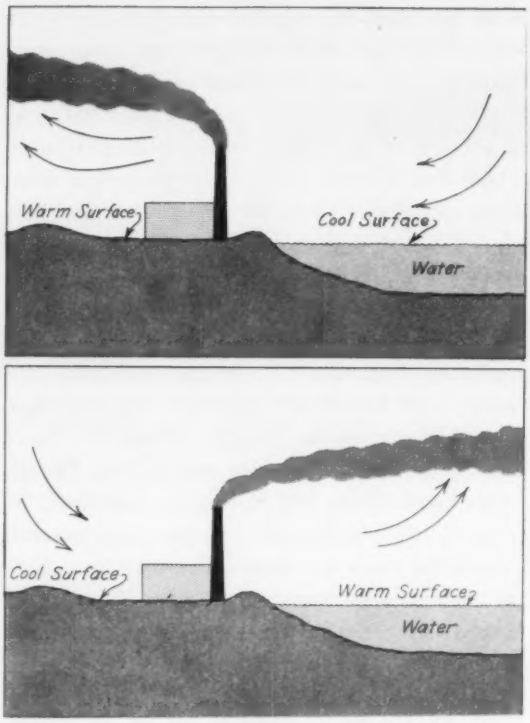
1) History of air pollution in the region.

2) Proximity and location of residential and agricultural areas and their relation to plant site and prevailing winds.

3) Climatology of region as defined by Weather Bureau or other available statistics.

4) On-site evaluation of wind speeds and directions and the influence of adjacent topography.

Methods of employing data obtained in local surveys to estimate ground level concentrations of pollutants from stack discharges and potential for pollution are given in References 14 and 18.



7 LAND AND SEA BREEZES or land and lake breezes disperse contaminants in cities adjacent to large bodies of water. When land is warmer than water winds flow inland, reverse when land is cooler than water. Since these variations may occur daily, prediction of concentration of pollutants is made more difficult

Available knowledge in this area is limited but research is continually adding usable information for application of meteorological data to the problem.

Legal Requirements Tighten Control

As the public becomes more conscious of air pollution and its potential effects—either through exposure or publicity—pressure is placed on public officials to enact air pollution control legislation. To date many cities have enacted legislation to control air pollution. Following enactment of broad programs with only general requirements for control of emissions, amendments are made to tighten control through more stringent requirements.

An example of tightening of control to eliminate specific pollutants, was the passage of Los Angeles Anti-Smog Rule No. 62. This regulation forbids the burning of fuel oil with sulfur content

in excess of 0.5 percent from April through October. The effect of this regulation on commercial and industrial users of fuel oil is obvious. However, since sulfur dioxide is one of the irritants in the Los Angeles smog, this ruling is one available means of reducing sulfur emissions. Two other means of controlling such emissions are available. One would be desulfurization at the refinery, and the other would be through cleaning of the stack gases.

As indicated earlier, one of the first considerations in design of control equipment is the legally permissible emission rates of contaminants. At present the dust loading requirements vary appreciably from city to city as indicated in the requirements of four cities listed in Table 7. Variance in dust loading requirements may be expected since the industrial density of a community influences the total amount of dust that may be emitted without causing annoying air pollution. However, standardization of dust loading requirements would be helpful in development of control equipment, methods of testing and rating, and in the application of equipment to a given process. The American Society of Mechanical Engineers has prepared a model ordinance which contains a dust loading requirement of 0.85 lb of dust per 1000 lb of gas adjusted to 12 percent CO_2 content in the case of fuel burning equipment. This has been used in many cities but more stringent requirements may follow more complete area air pollution surveys.

For example, as a result of the Louisville survey (12), the following recommendations were made:

"1) To reduce the emission of solid particles produced by the burning of fuel: Strict adherence to a standard prohibiting the emission to the atmosphere of solids in excess of 0.85 lb per 1000 lb of flue gas adjusted to 50 percent excess air for products of combustion. The Board should seriously consider lowering this figure in order to insure cleaner air. In addition, the Board should establish a maximum daily tonnage limitation on emission of solid particles from any one plant.

"2) To reduce emission of solid particles produced by industrial operations: A regulation that no industrial process plant shall from such process operations emit to the atmosphere more than one ton per day of solids."

The special requirements for dust emission by steam generating plants (Table 8) for New York City may appear to penalize the larger installations. However, the total daily emission of particulates is as important as the hourly rate in community air pollution. Thus, the larger systems, which contribute more heavily to total dust loading, are required to do a more effective job of cleaning. A one million pound unit will emit nearly four times as much dust as a 100,000 lb unit under the requirements of Table 8.

TABLE 7—EXHAUST GAS DUST LOADING requirements of several air pollution control ordinances shows variety of conditions

City	Type of Discharge	Dust Loading	Comments
Chicago	Process	0.35 grains per cu ft at 60 F, 30 in. Hg	0.655 lb dust per 1000 lb dry air. Ordinance permits increase of discharge of particulates less than 10 microns up to 0.03 $(H/100)^2$ where H = stack height in ft. Emission of particulates greater than 44 microns limited to 0.21 grains per cu ft (0.39 lb dust per 1000 lb dry air).
	Combustion of solid fuel	Same as above but adjusted to 50 percent excess air	
Kingsport, Tenn.	Combustion of solid fuel	0.35 grains per cu ft at 350 F and 50 percent excess air	1.0 lb dust per 1000 lb dry air. Applicable when coal is burned wholly or partly in suspension.
Nashville	Combustion of solid fuel	0.75 grains per cu ft at 500 F and 50 percent excess air	2.59 lb dust per 1000 lb dry air. Emission of particulate larger than 325 sieve (44 microns) limited to 0.20 grains per cu ft (0.27 lb dust per 1000 lb dry air).
New York City	Other than steam generation	0.85 lb dust per 1000 lb of gases	Adjusted to 50 percent excess air for combustion processes. Emission of particulate greater than 325 sieve (44 microns) limited to 0.40 lb dust per 1000 lb gases.
	Steam generation	See Table 8	

From air pollution control regulations of cities listed

TABLE 8—DUST LOADING REQUIREMENTS for steam generating equipment in New York City

Steam Generated, lb per hr	Pounds of dust per 1000 lb of steam
100,000 or less	2.2
150,000	1.9
200,000	1.7
300,000	1.4
400,000	1.2
500,000	1.1
600,000	1.0
800,000	0.9
1,000,000 or more	0.8

Interpolation permitted for intermediate capacities
From New York air pollution control regulations

While most air pollution control legislation to date has imposed restrictions on emission of particulate matter, Los Angeles County control regulations affect the operation of every industry in the area. Present controls place restrictions on emission of hydrocarbons, sulfur oxides, visible plumes and fumes, in addition to control of particulate discharge. The philosophy of Los Angeles in enactment of control legislation was stated by R. L. Chass, director of engineering of the control district, in his paper at the National Conference on Air Pollution (1). Because of its relevancy to the air pollution problem everywhere it is repeated. He said, "To meet constitutional requirements, air pollution control rules and regulations must not be unreasonable, capricious or arbitrary. Evidence must be provided by the District showing that compliance with the standards imposed by the rule or regulation is possible, and that persons therefore will not be denied their rights to engage in lawful occupations. In essence, this requirement means simply that a 'reasonable' solution must be available before any industrial source problem can be solved through legal compulsion.

"In short, our engineering and control technology must stay one pace ahead of our legally compulsory control enactments."

[The editors wish to acknowledge the assistance provided in assembling the information in this article from the many engineers and air pollution control officials who cooperated in providing data and guidance. Special acknowledgement is due those who permitted reference to the papers listed and those who have been quoted in the article. This discussion of air pollution control will be continued in a future issue.]

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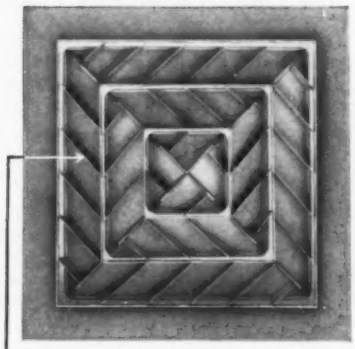

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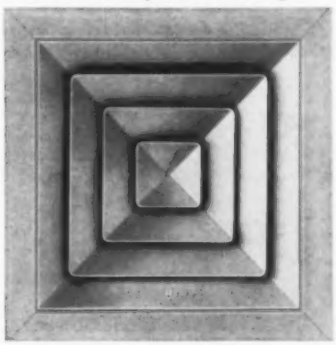

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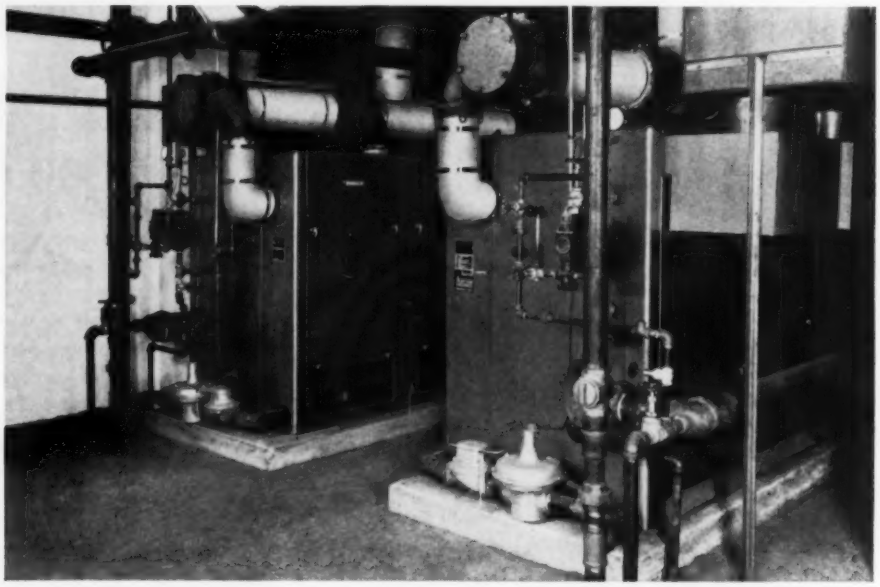

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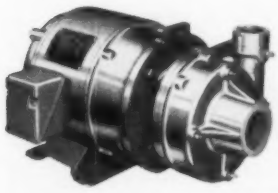
Here's the end suction pump line that combines performance, efficiency, versatility, convenience and *immediate availability* all in one package – the Peerless REDI-PAK. Comprised of 22 of the most popular size Fluidyne pumps, in sizes from 1 to 15 hp, the individually packaged, factory-fresh pumps are available *right now!* They're versatile, able to handle nearly every general purpose pumping job. They're well designed and soundly constructed. They're a compact pumping unit that fits easily into most all piping layouts. They're easy to maintain, operate indoors or outdoors, on continuous or intermittent duty.



Fluidyne REDI-PAK PUMPS

fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION
Peerless Pump Division
Plants: LOS ANGELES 31, CALIFORNIA and INDIANAPOLIS 8, INDIANA

PEERLESS PUMP DIVISION • FOOD MACHINERY AND CHEMICAL CORPORATION • 301 WEST AVENUE 26, LOS ANGELES 31, CALIFORNIA

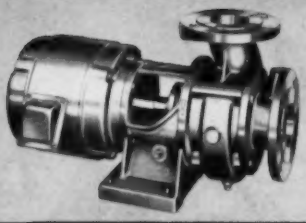
Please send Peerless Pump Bulletin No. B-2319 "Peerless REDI-PAK Pumps"

NAME_____ POSITION_____

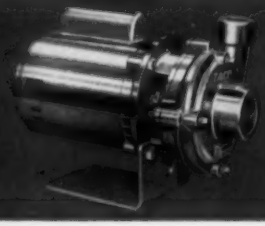
COMPANY_____ ADDRESS_____

CITY_____ ZONE_____ STATE_____

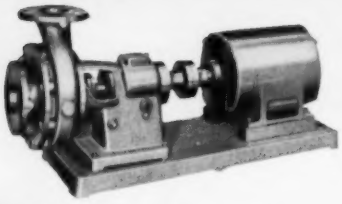
RIGHT DOWN THE LINE – TACO PUMPS PACK THE PERFORMANCE THEY PROMISE



TACO LP PUMPS A complete line of standardized close coupled pumps of outstanding quality and performance for heating, air-conditioning and industrial applications.

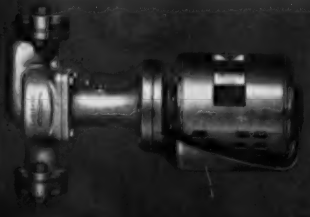


TACO 170 CENTRIFUGAL PUMPS Perfect for cooling tower jobs; air-conditioning installations . . . wherever a small, top-quality built centrifugal pump is needed.



TACO LP BASE MOUNTED PUMPS Similar in capacities, quality and performance to the close coupled line except equipped with a rugged cast iron base plate.

TACO PERFECTA The world's finest circulator; so vibrationless you won't believe it's running even when you touch it.



TACO CIRCULATORS Packed with quiet power and proven performance, sizes ¾" through 3"

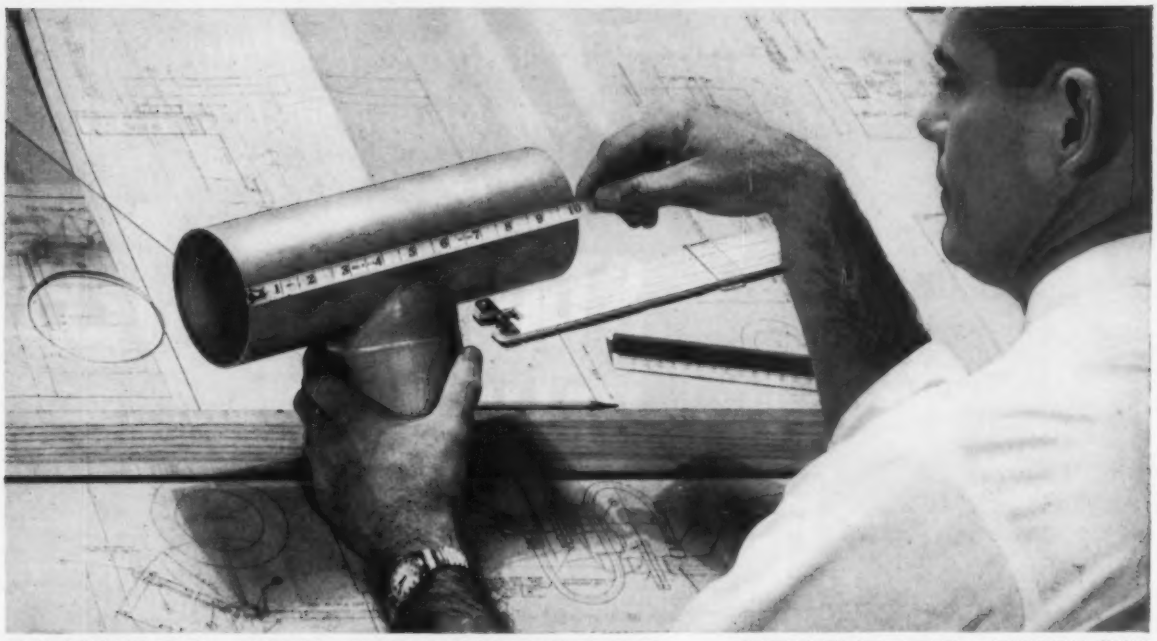
Write for literature or catalog.

TACO HEATERS INCORPORATED

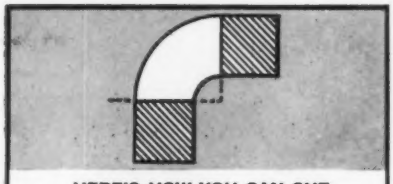
1160 Cranston Street, Cranston 9, Rhode Island

Taco

Serving the Hydronic Industry Since 1920



SAVINGS ARE MEASURABLE...START TO FINISH WITH *LONGER LENGTH* SPEEDLINE FITTINGS



HERE'S HOW YOU CAN CUT PIPING COSTS

A conventional 90° elbow is shown inside the dotted line. The shaded areas indicate the extra length you get with a Speedline fitting—at no extra cost. For example, on a 3" Speedline Elbow it means 4" more pipe. Thanks to the longer length of all Speedline fittings, all types of joints are made more easily . . . cost less . . . than with conventional fittings. Make your own comparisons.

For location of Authorized Distributor nearest you, see Speedline listing on page 593 in Chemical Engineering Catalog.

With this 3" Speedline Tee you get 3¼" "*more length*" at no extra cost. Speedline's *tangential feature* cuts costs and design detailing, too . . . lets you select the best joint to meet assembly requirements . . . means more clearance for welding and easier pipe aligning. Flange where you want to, weld where you want to . . . *any* type joint can be used on *any* or *all* ends of a Speedline corrosion resistant fitting!

Greater flexibility of Speedline long length fittings adds up to faster assembly and *lower installed costs*—even for the most complex process piping system. And, of course, Speedline corrosion resistant fittings *cut material costs two ways:* they give *more* pipe length per fitting and they facilitate use of economical *light wall stainless* steel pipe.

Before you plan any new installation or system addition, investigate the many advantages of Speedline's *tangential* feature. Write for Speedline Catalog showing how you save with the complete line of Speedline fittings.

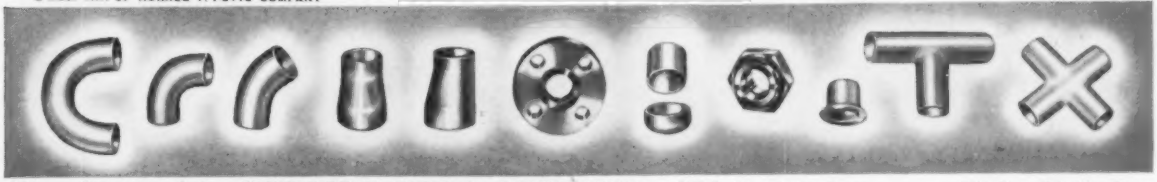
Speedline®

® REG. T.M. OF HORACE T. POTTS COMPANY

STAINLESS STEEL FITTINGS

SPECIALLY DESIGNED FOR SCHEDULES 5 AND 10 PIPE

P-900



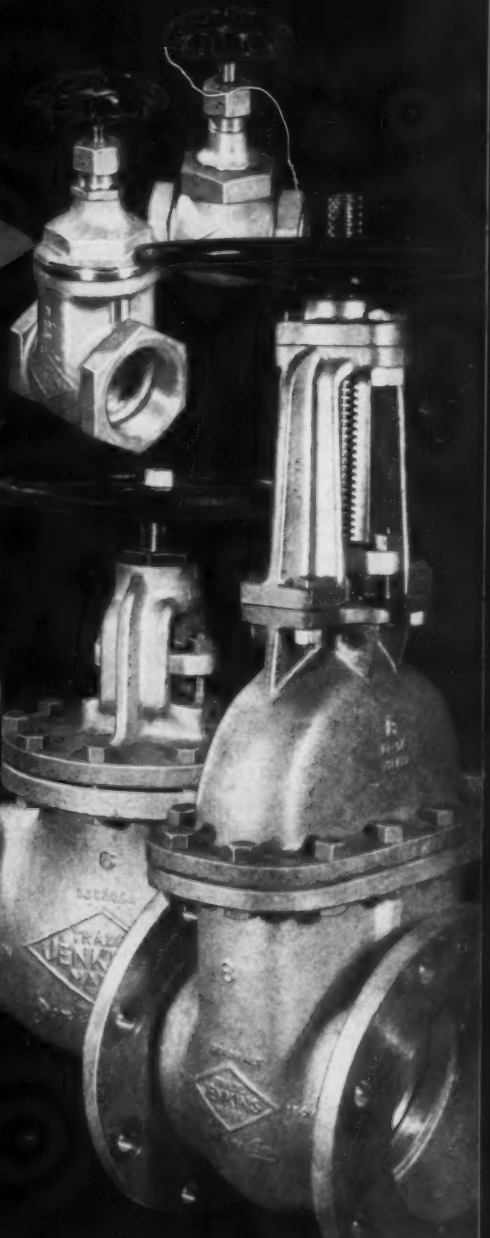
Manufactured by HORACE T. POTTS COMPANY • 576 E. Erie Avenue • Phila. (34), Pa.

It's a good feeling to see this trusted mark on your

STAINLESS STEEL VALVES *too*

JENKINS®

Jenkins Bros



PATTERNS AND ALLOYS TO SATISFY MOST INDUSTRIAL NEEDS

For solid reasons, men who ask for the best in Stainless Steel Valves have full confidence when they see the Jenkins Diamond. For almost a century this mark has appeared only on valves made to peak standards of quality in design . . . in castings . . . in machining. JENKINS standards, enforced by the most rigid inspection and testing in the valve industry.

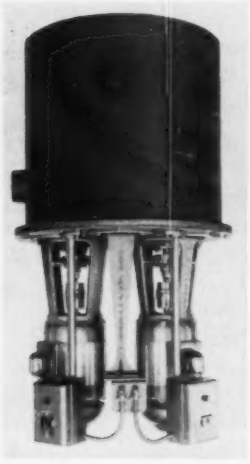
Valves of corrosion resistant stainless steels have been made to those high standards by Jenkins for a quarter of a century. And today, the line of Jenkins Stainless Steel valves includes types and alloys to fully satisfy most service requirements.

They are available through the same leading distributors everywhere who sell Jenkins Valves of Bronze, Iron and Cast Steel. Jenkins Bros., 100 Park Avenue, New York 17, N. Y.

NEW JENKINS STAINLESS STEEL VALVE CATALOG
Send for your copy today.

EQUIPMENT DEVELOPMENTS . . .

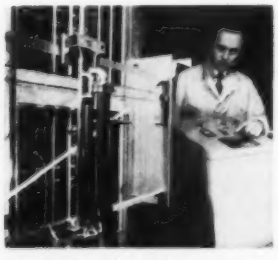
For reviews of Recent Trade Literature see page 186



Condensation Return Units

. . . designed, constructed for industrial, commercial, institutional installations where gravity condensate return lines are located at or below floor level—*Federal Pump Corp., Dept. HPAC,* 1144 *Utica Ave., Brooklyn* 3.

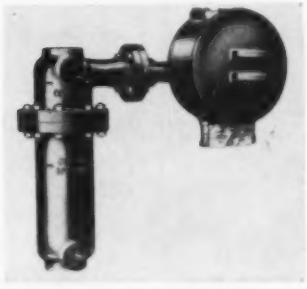
Units are of completely assembled type, vapor-tight, each with motor, ball thrust bearing and electrical control equipment elevated above cover of receiving tank. Features cited: quiet operation, dependable performance, accessibility. Pump, motor assembly and float switch assembly equipped with individual gasketed support plate.



Electronic Air Cleaners . . .

. . . in three specific cell designs to meet specific needs—*Minneapolis-Honeywell, Commercial Div., Dept. HPAC,* 2747 *Fourth Ave., So., Minneapolis* 8.

"Selector" series of electronic air cleaners includes following models: "Hi-Velocity" cell, providing for removal of 99 percent of dirt particles at 400 fpm; "Advanced Capacity/Maximum Efficiency" cell with 90 percent removal at 600 fpm; "Hi-Load" cell with air cleaning efficiency of 90 percent at 420 fpm. All air cleaners use "cell-washing" concept in operation. Can be equipped with activated charcoal filters.



Liquid Level Control . . .

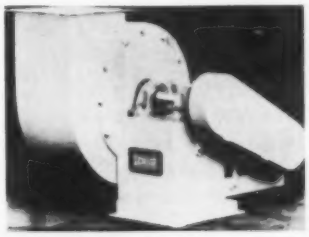
. . . designed for industrial and process applications—*Fisher Governor Co., Dept. HPAC,* 205 *S. First Ave., Marshalltown, Ia.*

"Level-Trol Type 2300" uses conventional pneumatic cage and displacer float as measuring element. Said to deliver proportional 1 to 5 milliampere d-c signal through 3000 ohm load. Standard 117 volt a-c employed as supply. Explosionproof design, external adjustments for proportional band and liquid level height intended to make model suitable for hazardous locations. Bulletin "F-85" gives details.

Solder Joint Valves . . .

. . . designed for copper tubing installations—*Kennedy Valve Mfg. Co., Dept. HPAC, Elmira, N. Y.*

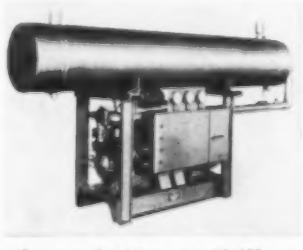
Solder joint valve has cylindrical shaped body, newly designed stem. "427SJ" gate valve used for water or steam lines where full flow is required with minimum pressure drop; "89SJ" globe valve recommended for heavier than average steam, water, air, or gas line operation; "440SJ" check valve intended for general service on steam, water, oil, or gas lines and can be installed horizontally or vertically. Bulletin "No. 581" provides installation and other data.



Induced Draft . . .

. . . said to have unique radiant heat cover between bearing and fan housing—*Lehigh Fan & Blower Div., Fuller Co., Dept. HPAC,* 124 *Bridge St., Catasauqua, Pa.*

Fan said to maintain constant over-fire draft, increasing combustion efficiency, eliminating need for large stacks. Capable of handling combustion gases to 800 F, fan is of all-welded mild steel integral construction. Radiant heat cover with aluminum heat flinger device said to prevent excessive heat radiation, permit use of standard pillow block bearings.



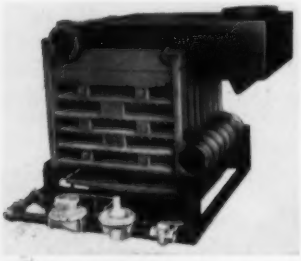
Packaged Water Chillers

. . . developed for air conditioning or industrial cooling applications—*American-Standard, American Blower Div., Dept. HPAC, Detroit* 32.

Redesigned "Type CD" line avail-

EQUIPMENT DEVELOPMENTS
Continued

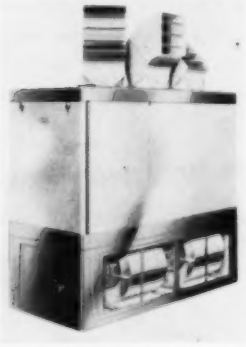
able in nine sizes 20 to 125 hp. Compressor driven directly by electric motor through flexible coupling. Capacity control actuated by crankcase suction pressure. Wiring is color coded throughout.



Cast Iron Boilers . . .

. . .manufactured in 33 sizes from 600,000 to 5,400,000 Btu input for steam or hot water systems—*Peerless Heater Co., Dept. HPAC, Boyertown, Pa.*

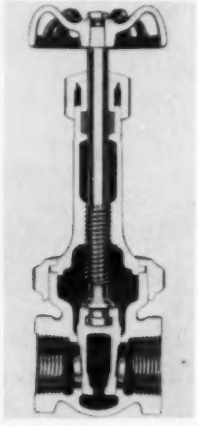
"Series 150" equipped with horizontal to vertical flue collectors and draft divertors. Assembly said to maintain predetermined maximum height of flue outlets regardless of boiler size. Boilers have cast iron core construction, six horizontal tubular water passages in closed "H" design form completely boxed gas passages.



Industrial Heaters . . .

. . .available in output ranges of 280,000 Btu per hr and higher, with oil, gas, or combination burners—*Lennox Industries, Inc., Industrial Div., Dept. HPAC, P. O. Box* 1294, *Des Moines* 5, *Iowa.*

Designed for unit heaters and central application, "OG" heater has following features cited by manufacurer: quiet blower operation; integrated burner design with switch controlled "dual fuel" burner for gas, oil combinations; combination air supply blower and individual draft blower mounted on single shaft and driven by single motor; units built in two separate sections, permitting individual use of blower or furnace sections. Units available in floor, inverted or horizontal design.



Gate Valves . . .

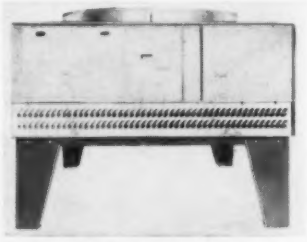
. . .with union bonnets designed to permit frequent dismantling, reassembly for inspection, service—*Ohio Brass Co., Dept. HPAC,* 380 *N. Main St., Mansfield, Ohio.*

Gate valve's union design said to provide added strength at bonnet joint in addition to making leaktight joint. When union ring is pulled down, body and bonnet mating surfaces join for tight seal. Available in sizes from ¼ through 3 in. in pressure ratings of 125 WSP and 200 WOG; and 150 WSP and 300 WOG for steam, water, air, gas, gasoline, or oil, with discs in full open position. valves can be repacked under pressure.

Steam Atomizing Burner

. . .designed for adaptation to packaged firetube boilers—*Orr & Sembower, Inc., Dept. HPAC, Box* 1138, *Reading, Pa.*

Atomizing system uses steam from boiler at 40 psi to break fuel oil into fine mist for firing. During startup, air atomization used until sufficient steam pressure has been generated. No moving parts in system and purging flow of steam said to keep nozzle clean on shutdown.



Air Cooled Condensers . . .

. . .in vertical flow design—*McQuay, Inc., Dept. HPAC,* 1600 *Broadway, N. E., Minneapolis* 13.

Designed for low silhouette, "Aircons" vertical flow condensers utilize effect of natural convection. "AB" model available in eight sizes from 7½ to 50 tons nominal capacity in single unit.

Centrifugal Fans . . .

. . .providing wide range of pressures, volumes—*Joy Mfg. Co., Dept. HPAC, Oliver Bldg., Pittsburgh* 22.

Sizes of "Joy-Centrifoil" centrifugal fans vary from 440 cfm at ¼ in. water gage static pressure for single width, single inlet fan to more than 460,000 cfm at 16 in. SP for double width, double inlet fan. Fan blades have airfoil shape. Said to meet requirements for commercial and industrial heating, ventilating applications, as well as for forced and induced draft combustion applications.

Oil Blending System . . .

. . .developed for blending No. 4 and 5 oils or any intermediate grade from No. 2 and 6 oils at rates to 500 gpm—*B-I-F Industries, Inc., Dept.*

US RUBBER EXPANSION JOINTS

*Architects: McAllister & Wagner, Los Angeles • Mechanical Engineers: Stockly & Bamford, Los Angeles • Vibration Control: M. W. Saussé & Co., Los Angeles

Playing it real cool...at Las Vegas

The revolutionary new cantilevered-floor Hotel Fremont* in downtown Las Vegas is the tallest building in Nevada. Of course, it has the latest in air-conditioning. And that was a big problem to lick.

Subsurface water drainage, plus space-cost considerations, meant that all hotel mechanical equipment had to be located on the 11th floor. Would the air-conditioning pumps transmit vibration to the other floors? Would there be more rattle and roll in the pipes than in the game room?

Not if U.S. Rubber Expansion Joints were installed in the water lines, figured the vibration control engineers who had learned of their efficiency on other jobs. They installed four joints in the system, the first high-pressure, double-duct system used in Nevada. And the Fremont Hotel stays real cool and *quiet*.

These economical, flexible pipe line connections take up the stresses due to vibration, expansion and contraction in water and freon lines. They prevent the transmission of noise, and take care of misalignment. Service life is long because there are no moving parts to wear or bind.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

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Mechanical Goods Division

United States Rubber

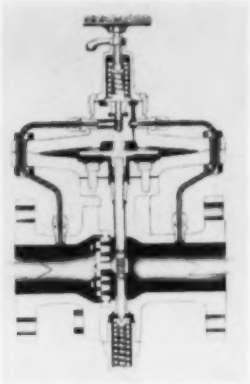
WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

EQUIPMENT DEVELOPMENTS
Continued

HPAC, 345 Harris Ave., Providence 1, R. I.

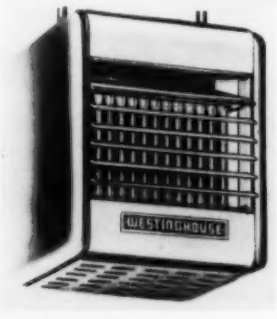
Use of "Proportioneer" blender allows blending of heavy viscosity No. 6 oils for industrial use with light viscosity No. 2 oils to produce intermediate No. 4 and No. 5 blends.



Pressure Reducing Valve

. . . incorporating company's patented sliding gate and plate main valve—*Jordan Industrial Sales Div. of OPW Corp., Dept. HPAC, 6013 Wiehe Rd., Cincinnati 13.*

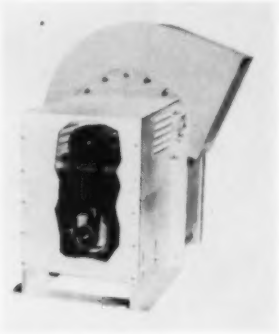
Piloted pressure reducing valve available in 2½, 3 in. sizes. Features cited by manufacturer: integral pilot with filter screen; oversize; clog-resistant passages, ball bearing adjusting screw with handwheel. Suitable for pressures to 250 psi and temperatures to 406 F.



Unit Heaters . . .

. . . available in 10 sizes from 25,000 to 250,000 Btu per hr—*Westinghouse Electric Corp., Sturtevant Div., Dept. HPAC, 200 Readville St., Hyde Park, Boston 36.*

Heaters incorporate contoured aluminized steel heat exchanger design with combustion occuring in tubes. Units equipped with fully automatic safety controls, and are available for any gas specified. Fan motors rated at 115 volts, 60 cycles, single-phase; equipped with automatic reset-type thermal overload protection.



Industrial Fan . . .

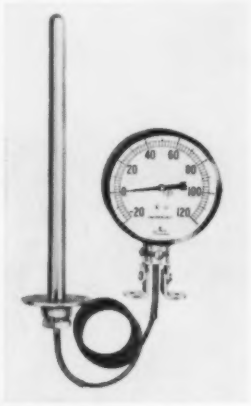
. . . developed for wide variety of industrial applications—*Robinson Ventilating Co., Dept. HPAC, 155 Henderson St., Zelienople, Pa.*

Unit said to be weathertight with motor and mechanism protected by steel enclosure. Design, construction permit use of open type motor. Fabricated from heavy gage steel with heavy duty split pillow block ball bearings, unit available in sizes for air flow rates of 650 to 16,000 cfm. "Type J" fan blade sizes range 12 to 27 in.

Motor Pump . . .

. . . with special impeller designed to eliminate gas binding, loss of prime —*Ingersoll-Rand Co., Dept. HPAC, 11 Broadway, New York 4, N. Y.*

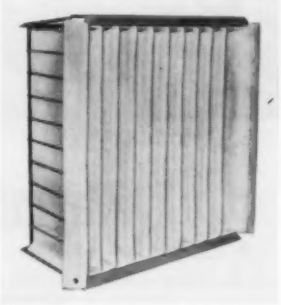
"Vapor-Flo" centrifugal motor pump designed for flooded petroleum suction services where vortexing, vaporizing may develop. Impeller has three vanes; impeller passages diverge toward periphery instead of converging, so that liquid leaves periphery faster than it enters eye and partial vacuum is formed. Built in sizes ranging 2 through 7½ hp; discharge connections 1½ to 3 in. Units for fully flooded suction handling of petroleum products range from 1/3 through 75 hp, with discharge connection openings to 6 in. and capacities 5 to 3100 gpm. "Form 70021" available from manufacturer describes product.



Dial Thermometers . . .

. . . designed for use in ducts—*James P. Marsh Corp., Dept. HPAC, 3502 Howard St., Skokie, Ill.*

Two types of duct thermometers available: direct mounted type; distant reading type, with 6 ft of capillary tubing. Temperature ranges available: −40 to 120 F with 2 deg divisions; zero to 160 F with 2 deg divisions; zero to 220 F with 5 deg divisions. Dial sizes are 3½ and 4½ in.



Folding Air Filter . . .

. . . developed for use wherever extra air cleaning efficiency is required—*Farr Co., Dept. HPAC, P. O. Box 90187, Airport Station, Los Angeles 45.*

"HP-2" disposable, dry-type filter consists of deep folded pleats of special media permanently attached to chipboard panels. Filter is fireproof, tearproof, fits into matching metal retainer which can be attached to most filter holding frames. No special tools required for installation.

"I cut welding time when

B&W Welding Fittings

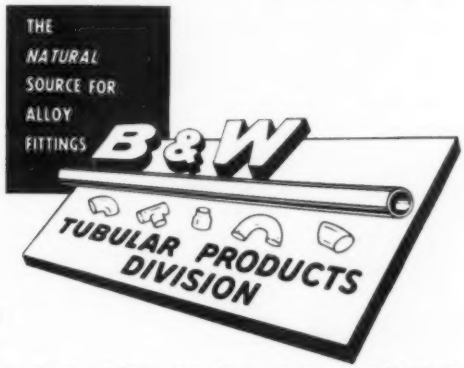
are specified!"

"From my own experience, I know that B&W Welding Fittings are dimensionally accurate and fit-up fast and positive. Welding time is reduced and one can make a trouble-free permanent joint. That means lower piping costs."

THE dimensional accuracy of B&W Welding Fittings makes a welder's job easier and helps to make his work more precise. Trouble caused by poor fit-up to pipe is eliminated. Every fitting has true circularity, full radius and walls of uniform thickness, which result in time saved in installation, top-quality joints, and helps to achieve a permanent, leak-proof, piping system. Write for bulletin FB504.

B&W Welding Fittings and Forged Steel Flanges are available in a complete range of types and sizes in carbon steel and the B&W CROLOYS.

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
3839 WEST BURNHAM STREET • MILWAUKEE 46, WISCONSIN



FA-8903-FEI

Seamless welding fittings and forged steel flanges, seamless and welded tubular products, solid extrusions — in carbon, alloy, stainless steels and special metals.

Just completed . . . a spanking-new plant at Institute, West Virginia, built by Union Carbide Chemicals Company to supply 50 million pounds of fluorocarbons a year! That means new UCON Refrigerants are available now . . . bringing you *all* the advantages of the nation's newest refrigerants. You'll get . . .

UNSURPASSED QUALITY, meeting the strictest refrigeration and air conditioning industry standards for dryness and purity.

NEW PERSONALIZED SERVICE from technically-trained representatives—the UCON Refrigerants service force is the largest in the country.

ON-TIME DELIVERY from the largest network of distribution points serving the refrigeration and air conditioning industries.

FULL CHOICE OF UNIT SIZES. Meet *your* quantity needs with UCON Refrigerants supplied in standard-sized units.

TO GET FULL DATA ON UCON Refrigerants now, see your wholesaler, or write: UCON Refrigerants, Union Carbide Chemicals Company, 30 East 42nd Street, New York 17, N. Y. Call, write or wire us, any time! Attention, Dept. F-2.

"Ucon" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Ucon
BRAND
refrigerants

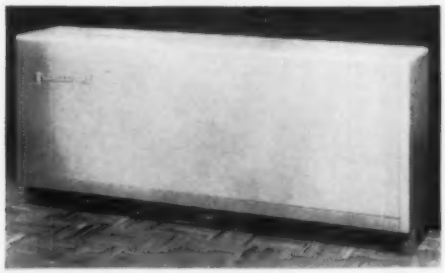
These 5 UCON Brand Refrigerants will meet your refrigeration and air conditioning needs

UCON Refrigerant 11 Trichloromonofluoromethane
UCON Refrigerant 12 Dichlorodifluoromethane
UCON Refrigerant 22 Monochlorodifluoromethane
UCON Refrigerant 113 Trichlorotrifluoroethane
UCON Refrigerant 114 Dichlorotetrafluoroethane

UNION CARBIDE CHEMICALS COMPANY *Division of Union Carbide Corporation*

EQUIPMENT DEVELOPMENTS

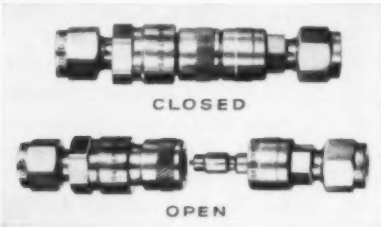
Continued



Unit Ventilator . . .

. . . available in two sizes, three coil arrangements each, for heating or heating and cooling with large range of capacities—*Valveblower Co. of California, Inc., Dept. HPAC,* 13735 *E. Rosecrans Ave., Santa Fe Spring, Calif.*

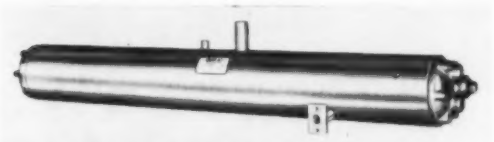
"Praetorian" unit ventilators have permanently lubricated bearings, hard anodized shafts and graphite-impregnated nylon bushings in all moving parts in order to provide quiet operation. Water valves eliminated for controlling the unit. Outdoor air inlets are 18 in. above floor.



Hose Fittings . . .

. . . in design with double end shutoff for use on pneumatic or hydraulic lines—*Crawford Fitting Co., Dept. HPAC,* 884 *E.* 140*th St., Cleveland* 10.

New fitting designed with seals in both parts of unit, said to prevent loss of pressure from either end of line when fitting is disconnected. Flow resumed when male, female units connected. Available in sizes for ¼ through ⅜ in OD tube.



Shell and Tube Condenser . . .

. . . in range of sizes from 5 through 100 tons—*Heat-X, Inc., Subs. of Dunham-Bush, Inc., Dept. HPAC, Brewster, N. Y.*

Heavy duty high capacity condensers specifically designed to simplify mechanical cleaning necessary in poor water areas. Rigidity of internal condenser provided by combining five tubes to a securely bracketed bank.

The Beaver Who Was Very Uneager

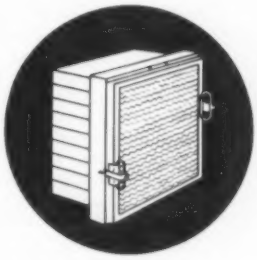
Once upon a time . . . there was a beaver who seldom seemed to work. While the other beavers were busy with the gnawing problem of selecting air filters, their uneager buddy would slip away.

One day they discovered that he had been meeting his friendly Far-Air man down by the dam and had been busy checking on a sample Far-Air HP filter. When they saw how easy this preformed filter would be to install . . . his secret was out! The beaver they thought was uneager had led them to a better filter . . . by a damsite.

Now all the beavers specify the economical Far-Air HP.

Moral:

Compare before you specify. Far-Air HP filters may meet your air filter requirements better. Gnaw off the coupon below, drop it in the mail . . . and relax.



FARR COMPANY

NEW YORK LOS ANGELES CHICAGO

FARR COMPANY
P. O. BOX 45187 AIRPORT STATION
LOS ANGELES 45, CALIFORNIA

Timber-r-r! Send me the new HP Filter bulletin before the pond freezes over.

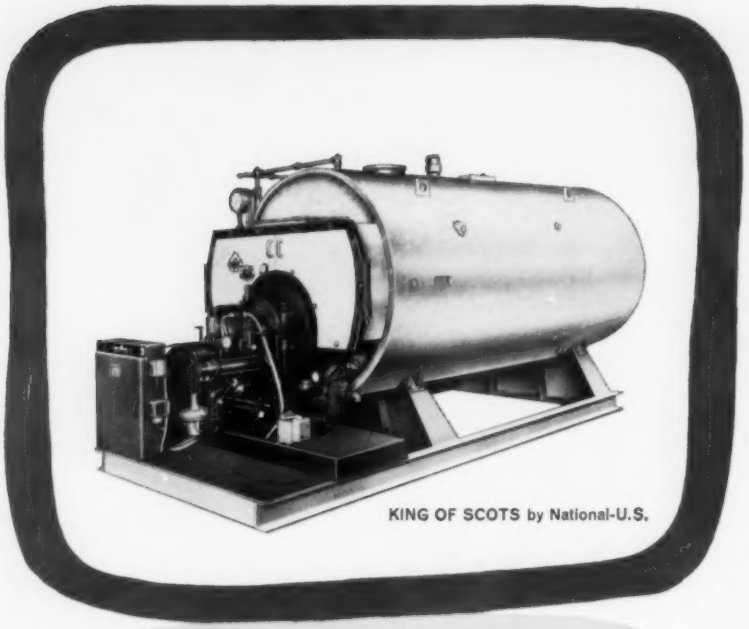
NAME _____

TITLE _____

COMPANY _____

STREET ADDRESS _____

CITY & STATE _____



Investigate the New "King of Scots" by National-U.S.

Here's a *new*, completely packaged "wet-back" boiler-burner unit for commercial, industrial and institutional heating and hot water supply. It saves headroom . . . has a lower water line . . . needs no special foundation.

The boiler, burner and all controls are completely assembled and wired, and the unit is pre-tested at the factory. Result: rapid installation and check-out, and complete assurance of satisfaction as covered by the National-U.S. guarantee.

This new bulletin tells you everything you want to know about the *new* "King of Scots" by National-U.S. Send for it today; ask for form #989.

58-04

National-U.S. Radiator
CORPORATION
HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania

Sixty years in thermal hydronics

EQUIPMENT DEVELOPMENTS
Continued

Blow-Off Valve . . .

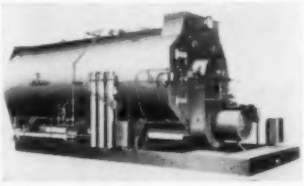
. . . for boiler blow-off pressures to 665 psi, basic rated pressure 400 psi —*Yarnall-Waring Co., Dept. HPAC,* 107 *Mermaid Ln., Philadelphia* 18.

"Unit Tandem" valve has forged steel block. Forms common body for hard seat blowing valve and seatless sealing valve. Valve stem is type 303 stainless steel.

Adhesives . . .

. . . developed to solve variety of assembly joining problems involving materials from minerals to rubber— *Eastman Chemical Products, Inc., Subs. of Eastman Kodak Co., Dept. HPAC,* 260 *Madison Ave., New York.*

New "910" adhesive said to be first bonding material developed that produces high strength bonds between virtually any combination of materials without excessive pressure, heat, solvent-evaporation, or long curing time.



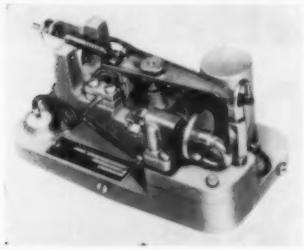
Package Boiler . . .

. . . in new 750 hp size, delivering 26,000 lb of steam per hr at 80 percent efficiency—*Cyclotherm, Div. of National-U. S. Radiator Corp., Dept. HPAC,* 157 *E. First St., Oswego, N.Y.*

Package boiler designed for heavy oil or gas, can be adapted to burn either LP gas or light oil. Overall dimensions of unit are: 28 ft × 9 ft, 6 in. × 10 ft, 8 in.

EQUIPMENT DEVELOPMENTS

Continued



Temperature Transmitter

. . . in −30 to 1200 F range—*Taylor Instrument Cos., Dept. HPAC,* 95 *Ames St., Rochester* 1, *N. Y.*

"Sensair" temperature transmitter said to be unaffected by normal plant vibration. Universal mounting bracket permits installation on flat surfaces, pipe lines, well wrench heads, pipe hangers or on separable bushings; and with various degrees of rotation.

Air Handling Unit . . .

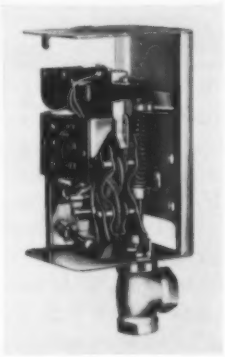
. . . with overall height of less than 28 in.—*Westinghouse Sturtevant Div., Dept. HPAC,* 200 *Readville St., Hyde Park, Boston* 36.

Unit, available in six sizes from 1130 to 9600 cfm, designed for installation in buildings requiring minimum space requirements. Equipped with chilled water cooling coils and steam or hot water heating coils, units rated at 4.3 to 36 tons cooling capacity and 108 to 920 MBtu per hr heating capacity. Construction is of insulated galvanized steel for horizontal air flow, and is to be suspended from ceiling.

Tube Threader . . .

. . . designed for ease and precision in threading brass tubing—*J. A. Sexauer Mfg. Co., Inc., Dept. HPAC,* 2503-05 *Third Ave., New York* 51.

"3-in-1 Tubing Threader" comes with 3 dies and guides for cutting 27 threads on 1¼, 1-⅜, 1½ in. brass tubing. Dies made of oil hardened tool steel with 8 lands. "5-in-1 Tubing Holder" made of high tensile strength aluminum alloy. Holder grips ½, 5/16, 1¼, 1-⅜, 1½ in. tubing for threading, flaring, or cutting.



Valve Switch . . .

. . . in completely enclosed, hermetically sealed design—*Edwards Engineering, Inc., Dept. HPAC,* 101 *Alexander Ave., Pompton Plains, N. J.*

Silent mercury switches now standard equipment on company's motorized zone control valves. Said to eliminate thermal leakage because of positive shutoff.

COMPLETE PACKAGE

SIMPLE INSTALLATION

LOW FIRE START

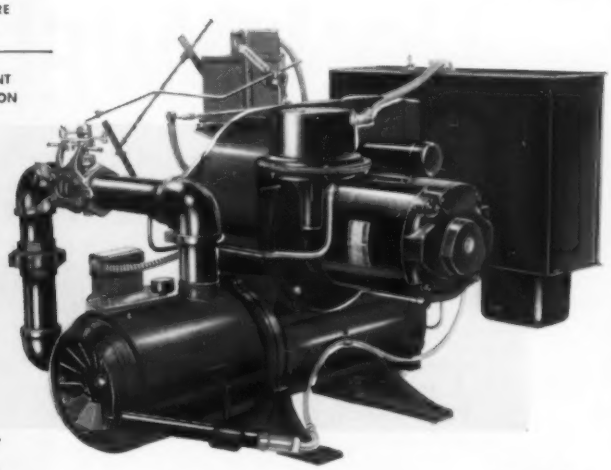
EFFICIENT OPERATION

FIRE TESTED

FULLY APPROVED

FACTORY GUARANTEED

HEV-E-DUTY POWER GAS BURNERS



Engineered for top performance under all weather conditions

Precision-engineered Hev-E-Duty power gas burners are the low-cost answer to high heating efficiency with gas. Automatic electric ignition assures safe starting. Built-in low fire start that builds up slowly to the flame size required means smooth, safe operation. Minimum low fire and maximum high fire can be controlled exactly for top efficiency with any boiler or furnace.

Once set, the burner maintains this setting automatically regardless of weather. Sizes from 720,000 to 21,000,000 BTU. Hev-E-Oil and combination gas/oil models also available. For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-259.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

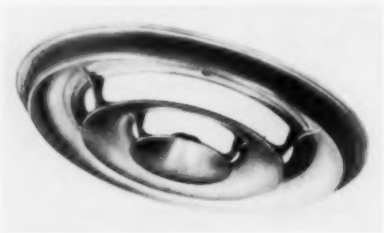
EQUIPMENT DEVELOPMENTS

Continued

Flexible Connector . . .

. . . developed to dampen vibration, pulsation from air conditioning equipment—*Korfund Co., Inc., Dept. HPAC,* 48-15 32*nd Place, Long Island City* 1, *N. Y.*

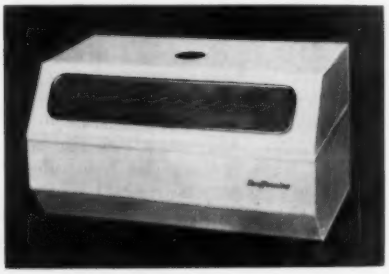
"Type F Flex-Hose" flexible metal connector for refrigerant lines made from corrugated, seamless bronze tubing protected, reinforced by covering of braid said to provide high burst strengths. Hose will withstand continuous operating temperatures to 400 F and working pressures to 150 psi, says manufacturer. Available in 10 sizes for fittings ¼ to 2⅛ in. OD. Standard hose lengths range 2½ to 32 in.



Plastic Ceiling Diffusers . . .

. . . produced in sizes to fit standard ducts, dampers—*AirGuide Plastics Corp., Dept. HPAC,* 7929 *N. E. First Ave., Miami, Fla.*

Diffusers guaranteed by manufacturer to withstand extreme temperature under actual heating, air conditioning usage and to be impervious to corrosive elements. Available in white and pastel colors.



Portable Humidifier . . .

. . . in new version of former design—*Herrmidifier Co., Dept. HPAC, P. O. Box* 145, *Neffsville, Pa.*

New "Model 654B Daffinaire" humidifier has corrosionproof case of solid brass construction; hinge stops designed to support lid when in raised position; rustproof, aluminum coated motor cover; replaceable double density filters; resilient neoprene motor mounts.

(*Continued on page* 174)

YOUR IDEAS WORK BETTER WHEN YOU WORK WITH HONEYWELL

THE FOLLOWING PAGES bring you some of the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 offices throughout the country; each staffed with control specialists to assist you in preparing proposals and writing specifications.

Look over these new products and systems. And, remember, they are backed by the kind of support only Honeywell can offer you.

EXAMPLE: From Honeywell's c exact pneumatic va

Single seated pneumatic valve

3-way pneumatic valve

This new line of Honeywell Pneumatic valves gives you superior performance characteristics, sharply upgraded ratings

BECAUSE valves supply the final control for over 90% of all temperature control systems, Honeywell has concentrated increasingly on the engineering of more dependable valves.

This newest line of Honeywell Pneumatic valves comes from four years of research, design and testing—an intensive development program which has produced a series of valves that set new industry standards for reliability and performance.

New valves provide wider limits of rangeability! These new valves provide accurate control of flow from the fully open position to the critical, hard-to-control light load situation. This has been made possible by these advanced design concepts:

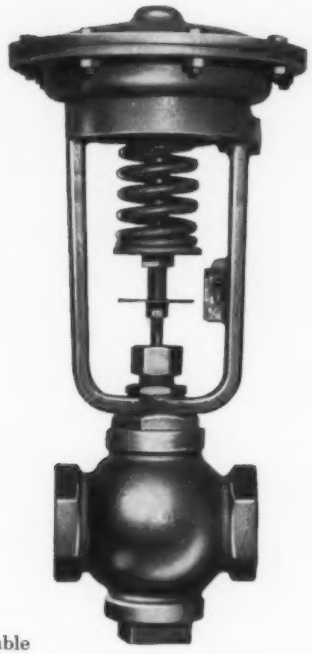
- A contoured plug or "characterized" V-port, precision made, provides a gradually-increasing rate of flow, giving far more sensitive fluid control.
- "Positive positioning"—made possible by the check-and-balance principle of the unique Honeywell Gradutrol relay. It assures accurate stem positioning regardless of changes in pressure differential.

They're designed for minimum maintenance. Precision design eliminates friction. Critical parts are made of durable, wear-resistant materials—Neoprene motor diaphragm, stainless steel stem, teflon packing, composition disc.

If repair is ever required, valve design permits fast, convenient parts replacement. For example, in most models the yoke can be removed to replace valve stem, packing, disc or seat without removing the valve from the line.

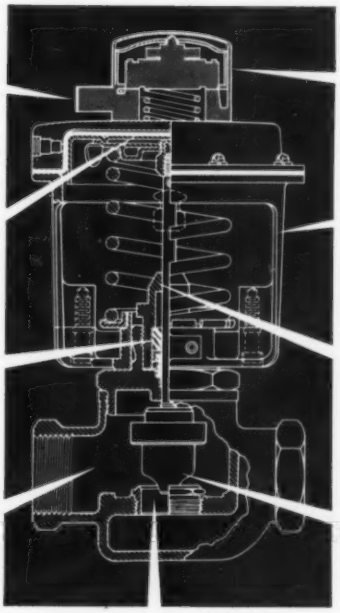
Honeywell Pneumatic valves are available in a wide variety of types and sizes—one to meet your exact requirement. Your Honeywell control specialist will supply you with complete specifications for the entire line, supply you with valuable assistance in choosing the valve to order. Call him at your local Honeywell office or write Honeywell, Dept. AC-2-32, Minneapolis 8, Minnesota.

complete line . . . the
valve to match your application



Series 400 double seated diaphragm valve

Series 400 single seated diaphragm valve



Air Connection Rotates 360° with Actuator.

Replaceable, Sensitive Roll Type Diaphragm.

Teflon Packings are Spring-Loaded and Self-Adjusting.

Large Flow Chamber Permits Higher Capacity.

Gradutrol Relay Insures Positive Positioning of Valve Stem.

2-Piece Yoke Simplifies Maintenance

Sliding Stem Retainer for Simpler Installation

Contoured Plug Insures Equal Percentage Flow at All Load Levels.

Seat Can Be Replaced without Removing Valve From Line.

EXAMPLE: Announcing Honeywell's New Electronic Air Cleaner Line . . .

THE SELECTOR SERIES!

This Selector Series of Electronic Air Cleaners now offers you a choice of three cell designs to match exact job requirements.

Hi Velocity Cell ¼ inch plate interval. Provides air cleaning efficiency of 95 per cent at an air velocity of 700 fpm. Specified when maximum cleaning is desired, when high velocities are encountered, or where installation space is limited.

AC/ME Cell 5/16 inch plate interval. Offers advanced capacity for dirt loading and maximum cleaning efficiency at moderate air flow rates. Ninety per cent efficiency at 600 fpm.

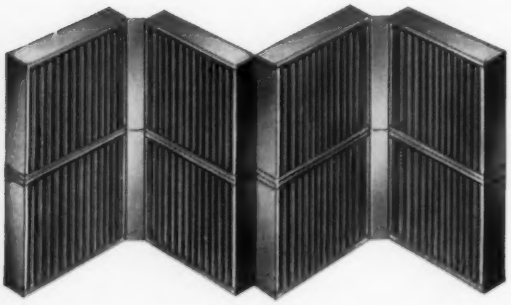
Hi-Load Cell ⅜ inch plate interval. Designed to provide greater capacity for dirt loading, less frequent washing. Rating of 90 per cent efficiency at 420 fpm.

Six times more efficient than mechanical filters, Honeywell Electronic Air Cleaners eliminate airborne dirt from the air conditioning system, trapping particles even as small as .001 microns.

A completely new washer has pliable nozzles that flutter as the water passes through giving faster, more efficient washing. The wash mechanism has been simplified and rearranged for smoother operation, less maintenance and less restriction to the air stream.

All Honeywell Electronic Air Cleaners are designed in building block modules. The frame is eliminated on field assembled units and simple button type connectors replace the old electrical connections. They offer the simplest, quickest installation available.

For the ultimate in pure air, specify Honeywell Activated Charcoal Filters with your Electronic Air Cleaner



Add Honeywell Activated Charcoal Filters to your Electronic Air Cleaner and you have the finest air cleaning system available. The Electronic Air Cleaner removes the dirt. The Activated Charcoal Filters remove the odors. And they help each other do a better job. For instance, the Electronic Air Cleaner, by removing dirt efficiently, prevents the charcoal filter pores from becoming clogged. They last longer without reactivation, work better.

Activated Charcoal Filters pay for themselves in reduced air conditioning costs because they reduce the amount of outdoor air required to dilute odor. And with Honeywell's new V shaped arrangement of building block modules, more charcoal filters can be put into the air stream without sacrificing easy access for reactivation.

For more information about Honeywell Electronic Air Cleaners or Activated Charcoal Filters, call your local Honeywell office. Or write Honeywell, Dept. AC-2-32, Minneapolis 8, Minnesota.

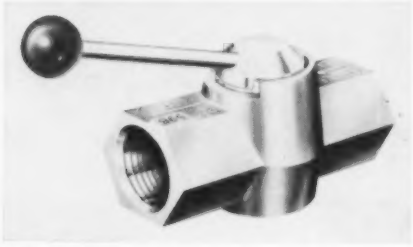
Honeywell

H HONEYWELL *First in Control*

FOR MORE TO WORK WITH WORK WITH HONEYWELL

EQUIPMENT DEVELOPMENTS

Continued from page 170



Plug Valve . . .

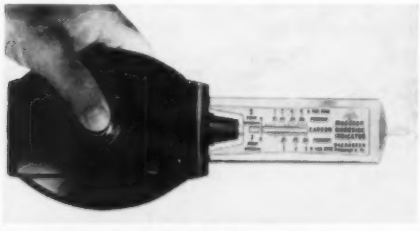
. . . developed for service suitable for vacuum to 150 psi in non-corrosive liquids or gases—*Circle Seal Products Co., Dept. HPAC, 2181 E. Foothill Blvd., Pasadena, Calif.*

The "9200 Series" plug valve, said to provide absolute leakproof shutoff, now available in added ⅛, ¼, ½, ¾ in. female pipe sizes. Design, incorporating three o-rings, said to eliminate adjusting nuts and springs.

Pipe Insulation . . .

. . . formulated to provide complete fire resistance—*Owens-Corning Fiberglas Corp., Dept. HPAC, National Bank Bldg., Toledo* 1, *Ohio.*

"FRJ" flame retardant jacket applied by factory around premolded, incombustible glass fiber insulation. Vapor barrier jacket composed of foil and kraft paper bonded together with flame-extinguishing adhesive, reinforced with glass fiber strands. Can be used as barrier for all types of hot or cold piping up to 400 F. When temperature reaches combustion stage, gases or vapors are released, tending to smother flame.



Carbon Monoxide Indicator . . .

. . . developed for detection and direct percentage measurement of carbon monoxide—*Bacharach Industrial Instrument Co., Dept. HPAC, 200 N. Braddock Ave., Pittsburgh* 8.

Mechanically operated instrument has no electrical circuit, may be used in presence of flammable gases. Percentage of carbon monoxide indicated by length of stain in indicating tube. Indicator has four scales; range of each scale depends on number of pump strokes; each pump stroke draws 16 cc sample through indicating tube. Can be used in ambient temperatures from −70 to 125 F. Indicating tubes may be capped, retained for examination up to 24 hr.

Pipe Hole Saws . . .

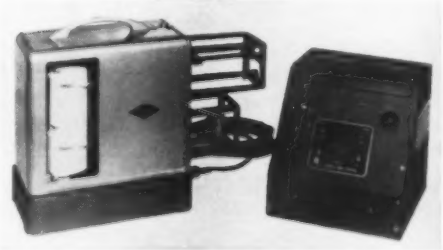
. . . for cutting holes for pipe risers through wooden floors, ceilings, partitions—*R. M. Starbuck & Sons, Inc., Dept. HPAC, P. O. Box* 1318, *Hartford, Conn.*

Saws are 2-¾ in. deep with long spiral flutes, no projecting shoulder and long, large diameter drill. Available in sizes ½ through 2 in.

Fusible Links for Valves . . .

. . . in four increased temperature ranges—*Cooper Alloy Corp., Dept. HPAC, Bloy St. and Ramsey Ave., Hillside* 5, *N. J.*

New links have melting points of 212 F, 250 F, 286 F, 360 F, respectively. Designed to permit installation of valve in networks and areas where temperature and/or processed fluids exceed 160 F. Links are color coded for distant identification of temperature service.



Humidity, Temperature Recorder . . .

. . . with variable range limit alarm—*Serdex, Inc., Dept. HPAC,* 12 *Bowdoin Sq., Boston* 14.

Indoor, outdoor two section humidity and temperature recorder has accuracy of ± 3 percent RH over 15 to 95 percent RH operating range at temperatures from 32 to 130 F. Design incorporates " animal membrane" humidity sensing diaphragm. Element of cantilever type bimetal is guaranteed accurate with ± 1 F from zero to 100 F. Alarm range detemined by locating electrical contact blocks on positioning post in sensing secion; signal cabinet may be remotely located.

TURN

TYPHOON

Adaptability of Typhoon air conditioning units is shown in this ingenious flush-mounting of units at the existing windows, thus eliminating expensive duct work in the main plant of the Indiana Gear Co. in Indianapolis. 176 tons of Typhoon waterless air-cooled equipment were installed.

AND SPECIFY THE RIGHT EQUIPMENT, FOR EVERY JOB, EVERY TIME!

Now you can fill every need, solve any problem with Typhoon's exclusive commercial, industrial and residential equipment! Save time for yourself and money for your clients with Typhoon custom-built air conditioning units. You can specify the air discharge and return arrangements you need, and the most practical location for utility service and maintenance access openings. Various combinations of compressors, cooling coils and blowers in the same cabinet provide infinite variations in performance characteristics. This extreme flexibility gives you custom made units at mass production prices. A full range of air cooled units from 2 tons to 20 tons, both packaged and split systems. Water cooled units from 3 tons to 75 tons, air cooled condensing units to 20 tons, water cooled to 75 tons! And the new Typhoon Heat Pumps that open a new era in air conditioning. Each and every unit with built-in Power Reserve—a combination of superior components and oversize parts that insures dependable performance above rated capacity through all weather extremes. All copper condensers in water cooled units, largest coil surfaces and rugged 11 and 14 gauge metal cabinets. Before you plan your next system, find out how Typhoon quality and flexibility can add to your reputation for getting the job done better, faster, more economically!

TYPHOON
DIVISION OF HUPP CORPORATION

Typhoon Air Conditioning Company, Division of Hupp Corporation
505 Carroll Street, Brooklyn 15, New York

☐ Have a representative call me for an appointment.
☐ Please send full product literature.

Name_____

Firm_____

Address_____

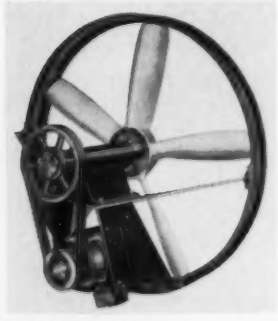
98-3

EQUIPMENT DEVELOPMENTS
(Continued)

Dust Collector . . .

. . . developed to operate in 2000 to 3000 cfm range—*Torit Mfg. Co., Dept. HPAC, Walnut and Exchange Sts., St. Paul, Minn.*

"Model No. 24" specially designed to handle large volumes of bulky dust with self-cleaning radial fan wheel. Variations of basic model intended for outside exhaust and heat saving, recirculation. Operated by 7½ hp motor, unit has 10 in. inlet and 12 in. outlet.



Belt Driven Fans . . .

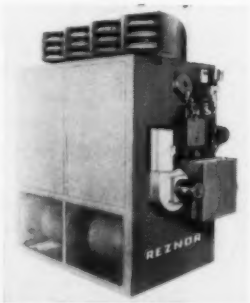
. . . designed for use wherever large volumes of air must be moved at relatively low noise levels and moderate pressures—*Propellair Div., Robbins & Meyers, Inc., Dept. HPAC, 1345 Lagonda Ave., Springfield, Ohio.*

"Type CB" designed principally for wall mounting; standard and heavy duty shutters available for such installations. Also may be used with power roof ventilators. Available in 42, 48, 60, and 72 in. sizes with free air deliveries ranging from 14,200 to 58,100 cfm. Airfoil section propellers of sparkproof aluminum magnesium alloy used. Fans driven by totally-enclosed motors, said to be protected against rust and corrosion.

Check Valve . . .

. . . with continuous cap rotation intended to eliminate incrustations, corrosion—*Check-All Valve Co., Dept. HPAC, 818 E. 22nd St. Ct., Des Moines, Iowa.*

New valve is patented nylon insert designed for cylindrical housing, incorporating neoprene o-ring, stainless steel spring, self-tapping cadmium plated screw. Valve cap rotates with natural spiraling motion as water, chemicals, petroleum, gases or air pass through; said to make valve clean, clear, increase working life of inset. Insert sizes range ½ through 2 in.; total unit weight from 0.8 to 6.5 lb; pressure ranges from 250 psi negative through 500 psi positive.



Forced Air Heaters . . .

. . . said to have advanced burner design, substantially lighter weight—*Reznor Mfg. Co., Dept. HPAC, 51 Union St., Mercer 8, Pa.*

"Series S" includes 10 sizes ranging in capacity from 400,000 to 2 million Btu per hr. All sizes available for gas, oil or dual-fuel firing and for up-flow or horizontal installation. Shipping weights range from 200 to 1500 lb less than on company's previous design.

Water Heaters . . .

. . . for small commercial installations —*Quiet Automatic Burner Corp., Dept. HPAC, 33 Bloomfield Ave., Newark, N. J.*

"Hi-Recovery" water heaters available in two new larger sizes: "No. 70G," glass lined with 180 gph at 100 F rise; "No. 65 T," copper lined with 180 gph at 100 F rise. Tanks may be connected in parallel to supply high hot water demand.

Pipe Hanger . . .

. . . with universal adjustable pipe hanger ring—"*Auto-Grip*" *Div., "Automatic" Sprinkler Corp. of America, Dept. HPAC, Youngstown 1, Ohio.*

"Auto-Grip" universal adjustable pipe hanger ring consists of a metal band and a locking insert for attachment to a threaded hanger rod. Insert is self-locking through spring action and through weight of pipe supported. Available in zinc or copper plate as standard, for pipe sizes ½ through 3½ in. Ring may be loaded to 500 lb.

Aluminum Pipe . . .

. . . with increased strength, thickness at pipe ends where welded or

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Peter Kiewit Sons Co.
general contractor

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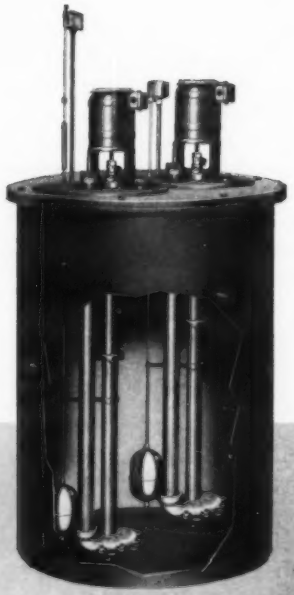
"Chicago" Vertical Duplex Sump Pumps Protect Bishop Clarkson Memorial Hospital

Quiet Operating . . . Low Cost . . . Dependable

"Chicago" Type LGL2 Vertical Duplex Sump Pumps are ready to provide instantaneous and lasting protection against flooding of vital mechanical equipment at the Bishop Clarkson Memorial Hospital . . . winner of The Modern Hospital Honor Award in 1955.

These pumps include a mechanical alternator to automatically transfer operation from one pump to the other, equalizing wear and allowing both pumps to operate when inflow to the basin exceeds the capacity of one pump.



LGL2 Vertical Duplex Sump Pump

IMPORTANT MECHANICAL FEATURES:

- Oilless guide bearings requiring no lubrication.
- Cast iron strainers
- Efficient bronze impellers
- Grease lubricated ball thrust bearings

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Provides full information on a complete line of Y type and Basket type strainers.

Mueller self-cleaning strainers will insure trouble free service and avoid the costly repairs or replacement of automatic equipment so often caused by the foreign matter in pipe lines.

Available in all pressures in Cast Iron, Brass, Steel or Stainless Steel in sizes ranging from ¼" through 16".

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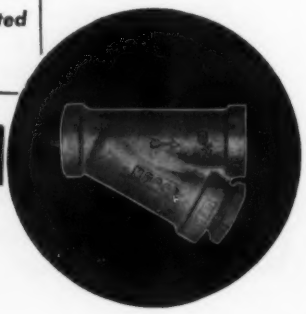
Pressure Drop Charts on Mueller Strainers— the results of actual physical tests conducted at Pratt Institute — are available on request in certified form.



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STEAM SPECIALTY COMPANY, INC.

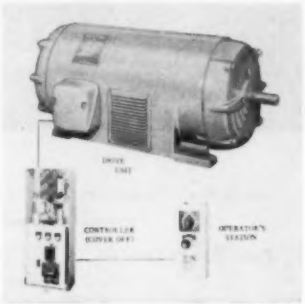
31 Meserole Ave., Brooklyn 22, N. Y.

EQUIPMENT DEVELOPMENTS

Continued

threaded joints are made—*Reynolds Metals Co., Dept. HPAC, W. Broad St., Richmond* 18, *Va.*

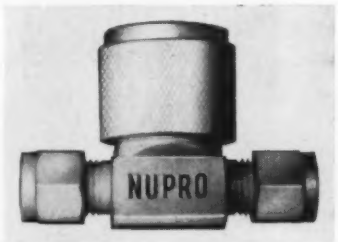
"Heavy End Pipe" offered in sizes equivalent to many standard Schedule 40 and 80 sizes. New extrusion process said to be flexible; can be adapted to wide range of diameters and wall thicknesses, according to manufacturer. Pipe ends are identical to those of standard pipe and are adaptable to grooving, threading, beveling for welding and preparation for other types of mechanical fittings. Standard fittings and flanges can also be used.



Adjustable Speed Drive . .

. . .available in ratings from ¾ to 7½ hp with stationary field construction—*Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee* 1.

Redesigned construction of "Adjusto-Spede" eliminates brushes, commutators, slip-rings, reduces length of drive 22 percent. Drive suitable for continuous operation at full load (constant torque) in ranges up to 34:1, and for intermittent use from zero to full speed, or any rpm between.



Vacuum Valves . . .

. . .in new design incorporating non-rotating stem—*Nuclear Products Co.,*

EQUIPMENT DEVELOPMENTS
Continued

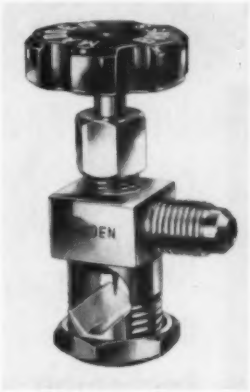
Dept. HPAC, 15635 *Saranac Rd., Cleveland* 10.

Valves specifically designed for use with high vacuum but may be used for process control, instrument air, corrosive conditions requiring use of plastic materials, etc. Available in polyethylene, nylon, other materials. All valve components in contact with fluid are of same material. Non-rotating stem said to eliminate galling between stem and valve seat. Available with "Swagelok" and pipe thread ends.

Oil Removal . . .

. . . from boilers—*Betz Laboratories, Inc., Dept. HPAC, Gillingham & Worth Sts., Philadelphia* 24.

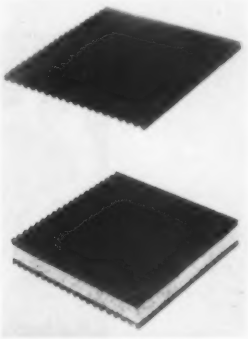
"Boil-Out" is prepared from organic and inorganic emulsifying and dispersive agents for use in removal of oil and grease from new boilers prior to placing on line. May also be used to remove oil from boilers contaminated due to operating conditions. Not recommended for removal of boiler scale or mill scale.



Tube Piercing Valve . . .

. . . developed for piercing ½ and ⅝ in. OD tubing—*Madden Brass Products Co., Dept. HPAC, P. O. Box 444, Aurora, Ill.*

"HP-810" designed for installation in any position without use of special tools or openers. Unit has two piece construction; v-block and nut combined in single unit. Made from extruded brass stock, unit can be installed on soft copper, aluminum, or brass tubing wherever liquid, gas, or air flow is desired.



Vibration Isolation . . .

. . . developed to prevent machinery travel, deaden noise—*T. R. Finn & Co., Inc., Industrial Div., Dept. HPAC,* 200 *Central Ave., Hawthorne, N. J.*

"PadZorber" neoprene mounting pads can be cut from 18 × 18 ribbed sheets to fit any shape under punch presses, drill presses, lathes, other

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for
ALL NUMBER ONE WELDS

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Built-in Timer Turns the Trick

Sheet metal shops ready for new speed, economy and completely uniform spot welds will want the new Lectro Spot. Here's why:

Operator depresses lever and,
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Tongs grip work at pre-set pressure;
Starter switch is actuated;
Weld sequence starts and stops automatically;
Result: EVERY WELD IS IDENTICAL!

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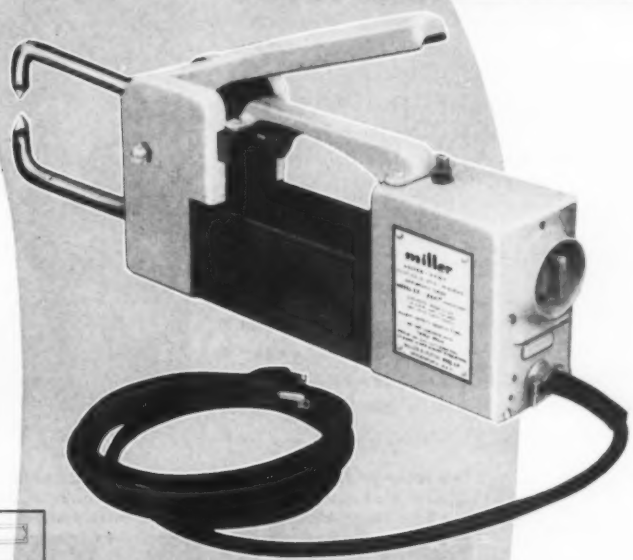
Three models in 115 or 230 volts weld mild steel of 1/8" to 3/16" combined thickness; 1.5 KVA weighs 29 lbs., 2.5 KVA weighs 39 lbs.

Wide choice of tongs available.



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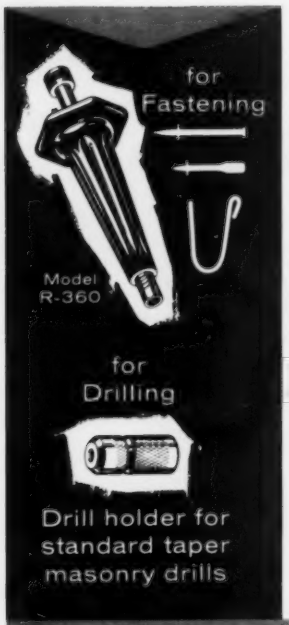

for quicker, easier fastening on every job

Stops costly, time-consuming pre-drilling, star-drilling, filling and plugging. These steps are unnecessary with versatile Shure-Set, the unique hammer-in fastening tool. Shure-Set requires no cartridge . . . converts hammer strokes into highly efficient power, driving "job-fitted" austempered fasteners into metal, concrete, mortar . . . seating them easier, up to 10 times faster than any other method. Save time and money on all light fastening —look for your dealer's name under "Tools" in the Yellow Pages.

In addition to hammer-in Shure-Set, the versatile Ramset Fastening System includes Ramset powder-actuated tools for heavy-duty fastening, and Ringblaster heavy-duty kiln gun.

Shure-Set — Olin Mathieson Chemical Corporation

Ramset Fastening System

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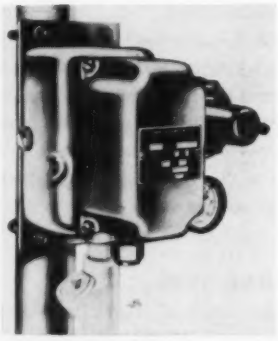
EQUIPMENT DEVELOPMENTS

(Continued)

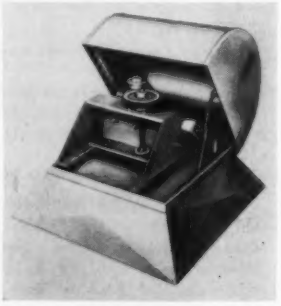
machinery. Manufactured in load ranges to 3500 lb per sq ft, pads may be used without bolting or built up bases.



Valve Operator . . .

. . . developed to operate standard pneumatic control valve in an electrical control loop—*Fisher Governor Co., Dept. HPAC, 205 S. First Ave., Marshalltown, Ia.*

"Type 543" transducer utilizes high capacity relay to produce pneumatic output pressure proportional to d-c milliampere input signal. Said to be suitable for input signal from 1 to 5 ma through 10 to 50 ma, with standard output ranges from 3 to 15 psi through 10 to 50 psi. May be serviced without disturbing electrical assembly. Factory balanced to operate in position without zero shift.



Roof Ventilators . . .

. . . designed to move large volumes of air quietly, continuously at moderate static pressures—*Power Line Fan Co., Subs. of Chelsea Products Co., Inc., 639 South Ave., Plainfield, N. J.*

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From 11 Basic Models
30 Possible Combinations

Self-Contained Unit
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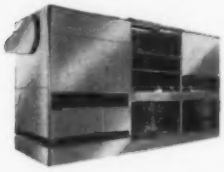


From 11 Basic Models
50 Possible Combinations

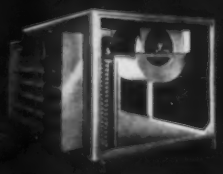
Self-Contained Unit
Shell and Tube Type ST

From 13 Basic Models
25 Possible Combinations

Self-Contained Unit
Multi-Zone Type STMZ

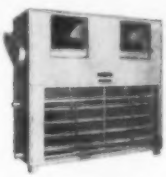
From 13 Basic Models
25 Possible Combinations

Horizontal Air Conditioner
Type GHC



From 14 Basic Models
56 Possible Combinations

Vertical Air Conditioner
Type GVC



From 14 Basic Models
56 Possible Combinations

Multi-Zone Air Conditioner
Type GMZ

From 14 Basic Models
84 Possible Combinations

Evaporative Condensers
Type EC

From 14 Basic Models
28 Possible Combinations

*ChillPak Water Chiller
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From 10 Basic Models
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Motor Operator . . .

. . . designed for fan coil unit, reheat coil, multizone damper, double duct mixing box control applications—*Barber-Colman Co., Dept. HPAC,* 1300 *Rock St., Rockford, Ill.*

Transistor motor operators can be connected to any 115 volt power source. Applications also include year 'round control of unitary air conditioners or induction units supplied with hot or chilled water. May be used with thermostat.

Air Hammer . . .

. . . developed for setting expansion anchors (concrete shells) in brick, masonry, block or solid concrete—*Superior Pneumatic & Mfg. Co., Dept. HPAC,* 4758 *Warner Rd., Cleveland* 25.

"Model SP-500" developed for use with standard chucks. Anchors up to 7/8 in. can be set. Hammer is 9½ in. long, weighs 4 lb and has metering trigger for controlling blows from zero to 2200. Hammer uses 11 cfm of air at 90 psi.

THIS heating and air-conditioning man found out—fast. It all started when he installed PLIOTRON super-filters in a metropolitan restaurant.

That one installation had spectacular results: For the PLIOTRON filters did far better than their predecessors. At the end of the year, filter costs had already been cut by 66% – with the filters still going strong.

That was only the beginning, too. For in a business where fresh, clean air is a "must," big news like this gets around. Soon this installer had a healthy PLIOTRON business among restaurants alone. Other industries soon caught on, as well.

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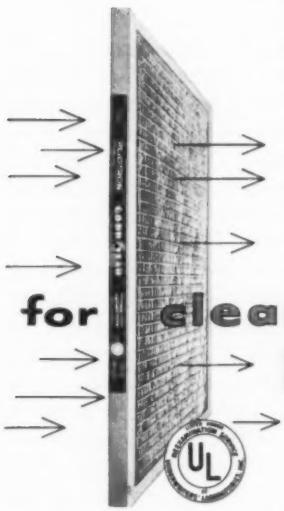

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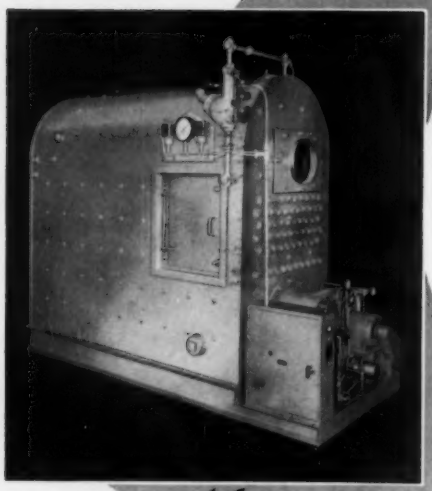

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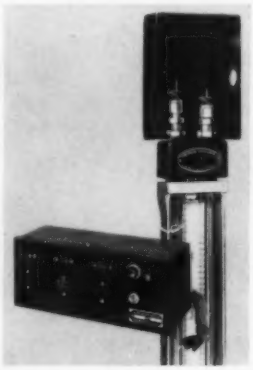
EQUIPMENT DEVELOPMENTS

Continued

Solenoid Valve . . .

. . . with pressure ratings to 4500 psi—*Valcor Engineering Corp., Dept. HPAC, 5370 Carnegie Ave., Kenilworth, N. J.*

"V-27200" designed to handle cryogenic fluids, ethylene oxide, jet fuels, high pressure pneumatics, liquefied gases, hydraulic oils in temperature ranges −320 to 500 F. Parts in contact made with fluids are plastic, stainless steel, and electroless nickel plated steel. Orifice size variations available from 750 psi to 4500 psi. Two-way, three-way and diverter types also available from manufacturer.



Pressure Switch . . .

. . . designed to give extremely accurate and sensitive response—*Meriam Instrument Co., Dept. HPAC, 10610 Madison Ave., Cleveland 2.*

"Manotac" consists of contactor manometer and relay-power-supply package. May be used for alarming and/or control applications with pressure, vacuum, differential pressure, flow and liquid level. Use of special indicating fluid (specific gravity-1) said to give control sensitivity of 0.005 in. of water. Instrument can sense pressure increments down to 0.003 oz per sq in. Switching functions handled by relay power unit which operates at 110 volts a-c. Units made in plug-in and tamperproof types. Available in five models for from one to five contact points. Contact capacity 5 amp per point at 115 volts a-c. ⫩

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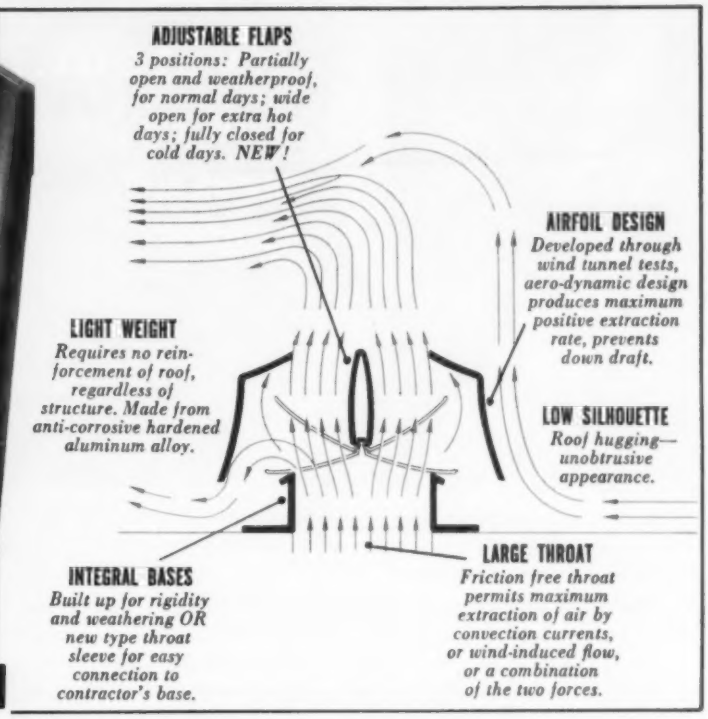
Low Air Flow Restriction — High Exhaust Capacity


ADJUSTABLE FLAPS
3 positions: Partially open and weatherproof, for normal days; wide open for extra hot days; fully closed for cold days. NEW!
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Developed through wind tunnel tests, aero-dynamic design produces maximum positive extraction rate, prevents down draft.
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Requires no reinforcement of roof, regardless of structure. Made from anti-corrosive hardened aluminum alloy.
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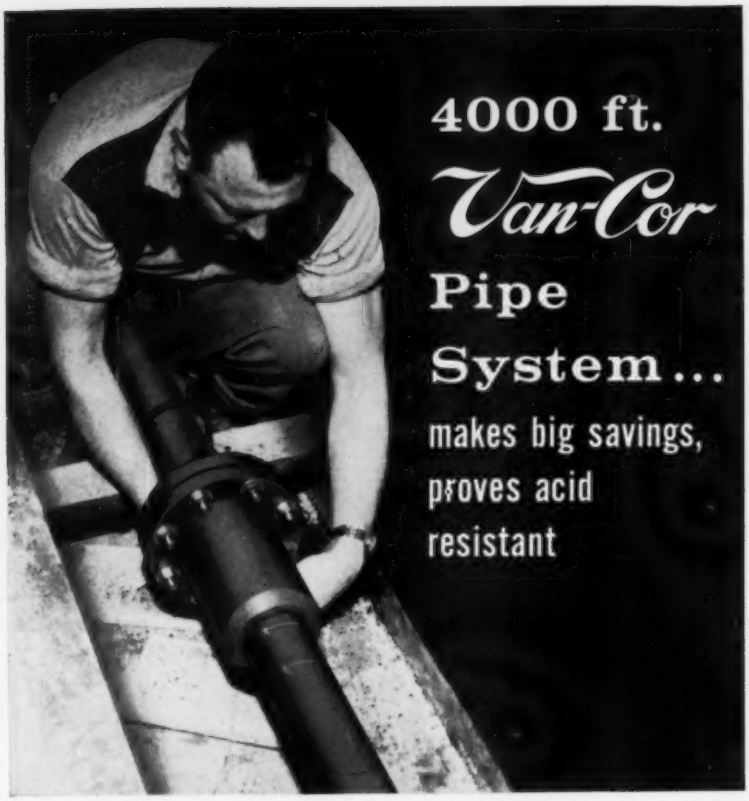


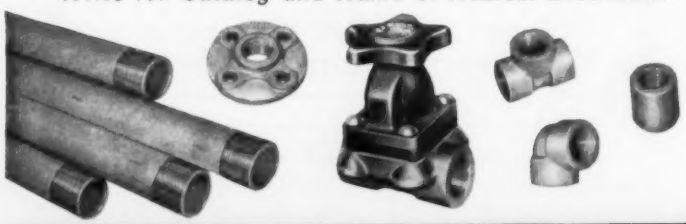
At the Allentown (Pa.) Works of the Western Electric Co., the entire waste acid disposal system in the recent addition consists of Van-Cor rigid PVC pipe and fittings.

HOW COSTS WERE CUT. Initial price of Van-Cor was ⅓ that of comparable cast iron alloy pipe. On a 6" line, labor costs were estimated at 29¢ per foot of run—about half that of metallic pipe. Also, because Van-Cor has only 1/10 the weight, no mechanized handling equipment was needed. Available in 10 or 20 ft. lengths, Van-Cor requires fewer joints, and eliminates the breakage problem.

CORROSION LICKED. Van-Cor pipe was used because "corrosion resistant" cast metallic pipe had performed short of expectations in an adjacent building. After 1½ years service, the Van-Cor system is in excellent shape, unaffected by such acids as hydrofluoric, hydrochloric, sulphuric, nitric and many plating solutions.

Investigate Van-Cor Pipe, Fittings, Valves, Electrical Conduit, and Fabrications . . .

Write for Catalog and Name of Nearest Distributor



INDUSTRIAL DIVISION OF . . .
COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
2685 EAST 79TH STREET CLEVELAND 4, OHIO

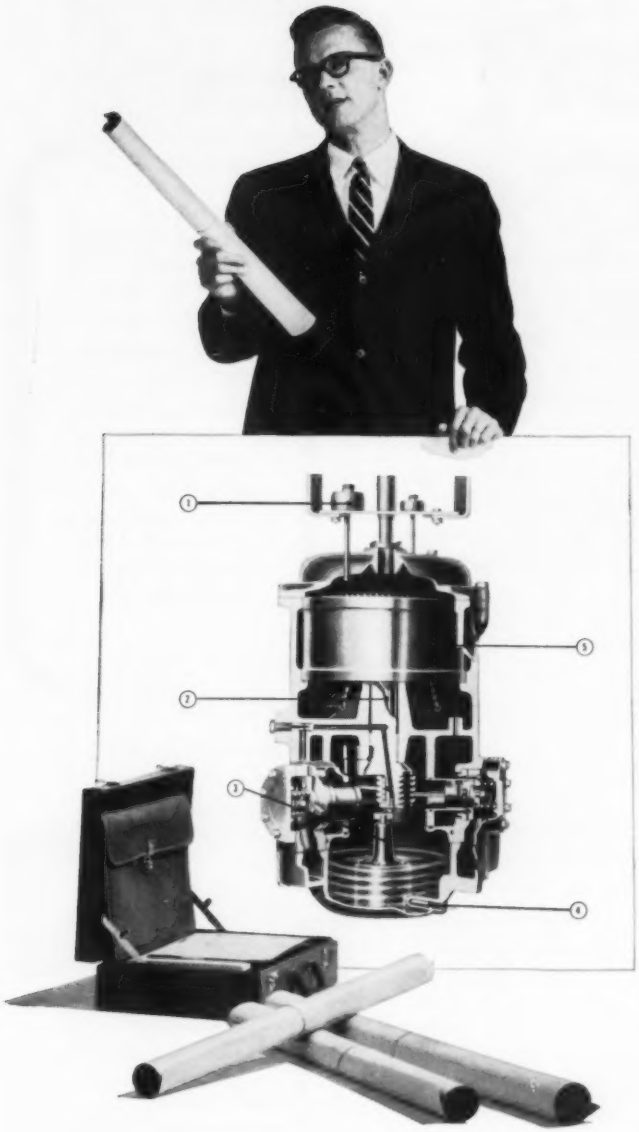
RECENT TRADE LITERATURE . . .

▸ *AIR CONDITIONERS*—New 12 page, illustrated brochure "Bulletin 9327" describes new line of "Diaflo" air conditioners. Features of units described, illustrated. Ratings given in tabular form for 200, 300, 400, 600 cfm sizes. Series of installation-type drawings provide dimensional data for basic units, styles. *American Blower Div., American-Standard, Dept. HPAC, Detroit* 32.

▸ *AIR COOLED CONDENSERS*—"Air-Cooled versus Evaporative Condensers" is title of 4 page reprinted paper "A-C, E-C No. 1" by C. W. Pollock, manager of the company's air conditioning and refrigeration. Paper discusses advantages, disadvantages of both systems. Material is illustrated with charts, diagrams. *Drayer-Hanson, Dept. HPAC, P. O. Box* 2215, *Terminal Annex, Los Angeles* 54.

▸ *ALUMINUM*—New 12 page folder details information on aluminum and aluminum fluxes available from company. Range of alloys now includes electrodes, welding rods, brazing rods, spooled wire for inert gas application, wide selection of solders for joint strengths to 25,000 psi, tensile, even where aluminum is used with metals of unlike kind. *All-State Welding Alloys Co., Inc., Dept. HPAC, White Plains, N. Y.*

▸ *CAST IRON BOILERS*—Illustrated, 8 page catalog presents company's series "150" gas-fired cast iron boiler available in 33 sizes for use with natural, manufactured and mixed gases. Unit ratings are from 600,000 to 5,400,000 Btu per hr input. Front and end view drawings, ratings, dimensions, specifications of each boiler given. *Peerless Heater Co., Dept. HPAC, Boyertown, Pa.*



Here are 5 of the 18 reasons why it pays to pick Chrysler Liquid Chillers

Cooling for comfort? Or cooling a process? Only Chrysler Airtemp SW Liquid Chillers offer so many exclusive engineering advantages. Take the hermetically-sealed radial compressor, for example. You get:

① *Floating power.* Rubber-in-sheer suspension absorbs vibration. Noise is gone . . . and so are vibration-caused service headaches.

② *Direct drive.* No belts, no pulleys, no seals to break down. You get greater efficiency, less noise from a more compact package.

③ *Positive lubrication.* Exclusive pressure pump is sealed in a bath of oil. Moving parts get constant lubrication for long, trouble-free life.

④ *Crankcase heater.* Prevents refrigerant from condensing and diluting lubricant. Oil stays clean . . . and always ready to flow.

⑤ *Sealed-in motor.* Dust-proof for longer service life. Directly connected to dynamically balanced crankshaft to cut weight and operating costs.

The rest of the 18 reasons? They include innerfin direct expansion chiller, automatic control panel, easier installation and . . . But why not get the complete story from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corporation, Dept. Y-29, Dayton 1, Ohio.

CHRYSLER AIRTEMP

FIRST WITH THE FINEST IN AIR CONDITIONING

Install Insulation with

TUFF-BOND

Super-Strength Adhesives

TUFF-BOND #7
... fire-retardant adhesive for installing insulation

TUFF-BOND M-102-H
... economical duct liner adhesive

TUFF-BOND 21-C
... clear lap sealer and lap adhesive

TUFF-BOND 21-W
... white lap sealer and lap adhesive

TUFF-BOND #500
... exceptionally high-strength chemical-set adhesive with wide thermal range −100° F. to 400° F.

TUFF-BOND #1000
... high heat resistance for bedding and installing high temperature insulation

TUFF-BOND #12
... high pressure duct sealer

TUFF-BOND QUIK-SET
... neoprene-base, fast-setting adhesive. Recommended for installing metal and nylon hangers to smooth surfaces.

TUFF-BOND GENERAL PURPOSE
... all-around adhesive for installing insulation, insulation hangers, etc.

Ask for descriptive literature and prices.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 26, ILLINOIS

RECENT TRADE LITERATURE

Continued

▸ *CONCRETE ANCHORS*—Two illustrated color brochures present company's complete line of concrete anchors and related accessories. Drives and anchors described in text, shown in photos. Charts give necessary dimensional information. *Polis Mfg. Co., Div. of Gregory Industries, Dept. HPAC, Toledo Ave. and E. 28th St., Lorain, Ohio.*

▸ *CONTROLLED VOLUME PUMPS*—"Bulletin No. 258" covers new line of company's "Milroyal" controlled volume pumps with totally enclosed drives. Bulletin presents design features, provides specifications. Pumps intended to meter chemicals against pressures to 1900 psi. *Milton Roy Co., Dept. HPAC,* 1300 *E. Mermaid Lane, Philadelphia* 18.

▸ *COPPER FLUXES*—New 12 page pocket folder answers questions on number of alloys and fluxes offered by company for work on copper and copper-bearing alloys in maintenance, production and installation. New folder describes alloys, fluxes and automatic fluxing system developed for work on copper. *All-State Welding Alloys Co., Inc., Dept. HPAC, White Plains, N. Y.*

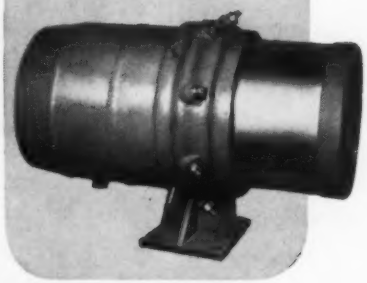
▸ *DUST CONTROL*—"Bulletin 82" treats variety of dust control problems, illustrates how they may be solved using equipment manufactured by company. Publication's 12 pages contain numerous photographs picturing installations of "Flexaust" hose and "Portovent" ducts in dust control applications. Table included gives complete dimensional information on hose, ducts and accessories. *Flexaust Co., Dept. HPAC,* 100 *Park Ave., New York* 17.

▸ *ELECTRIC HEATERS*—Illustrated, diagrammed 52 page catalog puts forth manufacturer's line of electric heaters and heating devices. Besides list of products information

important points about joints

- Yarway Gun-Pakt Joints are serviced *in the line under full steam pressure.*
- Costly shutdowns eliminated.
- Maintenance records show 1 manhour per year per joint.
- Fewer expansion joints needed per length of pipeline with Gun-Pakt.

YARWAY GUN-PAKT EXPANSION JOINTS



For new Yarway Expansion Joint Catalog EJ-1916 write YARNALL-WARING CO., 107 Mermaid Lane, Phila. 18, Pa.

go YARWAY with confidence

RECENT TRADE LITERATURE
Continued

on ordering, pricing and power requirement calculations given in tables, charts, text. *General Electric Co., Dept. HPAC, Schenectady* 5,

▸ *EVAPORATIVE CONDENSERS*—Design and performance data on "Perma-Fan" 13 line series of blow-through type evaporative condensers is subject of "Bulletin P-F 511.1". Publication includes dimensional drawings throughout. Table of dimensions, list of specifications also given. *Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC,* 3301 *Medford St., Los Angeles* 63, *Calif.*

▸ *FAN CURVES*—"Catalog 50C8a" contains complete set of fan performance charts for company's vertical and horizontal air conditioning units and multizone units ranging from 600 to 34,000 cfm. *Recold Corp., Dept. HPAC,* 7250 *E. Slauson Ave., Los Angeles* 22.

▸ *FRAMING SYSTEM*—New, expanded general engineering parts catalog on bolted metal framing system covers 1400 fittings in 180 pages. Illustrations, notes, aid identification of parts. Applications also covered. *Unistrut Products Co., Dept. HPAC,* 933 *W. Washington Blvd., Chicago* 7.

▸ *FUEL OIL TREATMENT*—Physical characteristics of "C-8" described in new bulletin. "Formula C-8" is combination of fuel oil treatment and soot remover. Information given includes methods of handling in storage, proper feed rates, application suggestions. *Bird-Archer Co., Dept. HPAC,* 4337 *North American St., Philadelphia* 40.

▸ *HIGH VELOCITY FILTER*—New 4 page bulletin describes company's high velocity panel impingement filter. Bulletin "B-100-2B" contains detailed information on standard "Type 44" filter. *Farr Co., Dept. HPAC, P. O. Box* 90187, *Airport Station, Los Angeles* 45.

This may be the answer to your heating problem!

VERTIFLOW® UNIT HEATERS by Young

Vertiflow Unit Heaters are *specifically designed* for heating areas with high ceilings, or where large "clear span" areas are required. Twenty-two sizes, and a selection of six different types of diffusers assure a choice to meet the specific need — according to the capacity and blow-down requirements.

Patented construction of Vertiflow Units represents the ultimate in unit heater design. The *exclusive* cooling stack is positive assurance of longer motor life. High temperature fusion bonding of tubes to headers — and use of *one piece* tubes, continuous from header to header — means longer, trouble-free life for the entire unit.

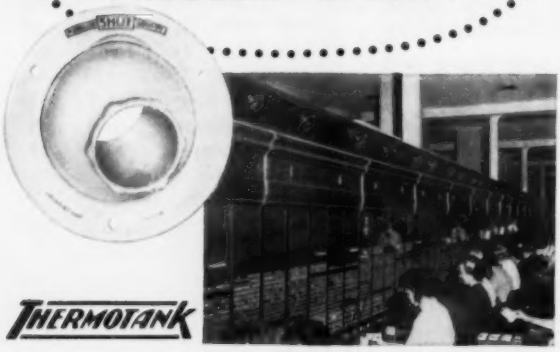
Giant Overhaul Hangar Utilizes 36 Vertiflow Unit Heaters by Young to Warm 18,480,000 Cubic Feet

This giant TWA Overhaul Hangar at Kansas City, Mo. has two interior areas, each 160′ x 818′ free from any obstruction (made possible by the shell and cable design of the roof), and is capable of servicing 10 Lockheed Super Constellations at one time. Vertiflow Heaters, with Dual Jet Revolving Diffusers, are suspended 45 feet above the floor . . . providing an adequate flow of warmed air to all areas.

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Write Dept. 519-B for Catalog 2659

FOR ANY DIFFICULT
SPOT COOLING OR HEATING
PROBLEM—SPECIFY



THERMOTANK

round type punkah louvres

More than thirty years ago THERMOTANK engineers designed, developed and installed round punkah louvres (the original jet air outlet) in ships sailing to the Far East. Since its original application in ships, the effectiveness of THERMOTANK punkah louvres has been widely used on an ever increasing variety of applications.

HERE ARE SOME REASONS WHY:

1. Finger-tip adjustment projects air stream in any desired location.
2. Provides the most effective throw for its size and pressure.
3. Ideally used for air distribution in remote areas where branch ducts cannot be accommodated.
4. Draftless, quiet operation . . . easy to balance.

THERMOTANK round type punkah louvres are recommended for any cooling, heating or ventilating requirement. For complete engineering data on round punkah louvres, ask for catalog TA-150.

THERMOTANK AGITAIR

high velocity units • punkah louvres
air diffusers • filters • exhausters
registers and grilles

Sold exclusively by representatives for:

AIR DEVICES INC.

185 MADISON AVENUE, New York 16, N. Y.

RECENT TRADE LITERATURE

Continued

▶ *HIGH TEMPERATURE WATER BOILERS*—Engineering data sheet gives information on basic flow design of high temperature water system. Illustrated with diagrams of company's "Flow Controlled" high temperature water boilers. Dimensional data given in chart form. *Boiler Engineering & Supply Co., Dept. HPAC, Manavon St., Phoenixville, Pa.*

▶ *HYDRAULIC POWER TOOL*—Illustrated catalog "A-5-58" covers independent pump hydraulic jacks, single and double plunger hand pumps and double acting air engine pumps. Products briefly described, illustrated; full specification data given. Catalog points out unit applications in single or group installations. *H. K. Porter Co., Inc., Forge and Fittings Div., W-S Fittings Works, Dept. HPAC, P. O. Box 95, Roselle, N. J.*

▶ *INDUSTRIAL THERMOMETERS*—Short form catalog covers complete line of thermistor based temperature measurement and control instruments. Descriptions of five new temperature ranges given. *Yellow Springs Instrument Co., Inc., Dept. HPAC, Yellow Springs, Ohio.*

▶ *METAL HOSE CONNECTORS*—Wide selection of standard flexible metal hose connectors illustrated, described, priced in catalog "No. 658." New line of wet heat connectors included in catalog. Descriptions, complete specifications, installation information given. *Cobra Metal Hose, Dept. HPAC, 5059 S. Kedzie Ave., Chicago 32.*

▶ *MOTORIZED GEAR DRIVE*—Recently published 4 page bulletin "No. 2350" presents company's "Line-A-Spede" motorized gear drives. Drives are gear reducers powered by standard NEMA frame motors mounted on shelf attached to reducer. Construction features illustrated in cutaway drawing; engineering specifications, dimensions given. *Louis Allis Co., Dept. HPAC, 427 E. Stewart St., Milwaukee 1.*

▶ *MULTI-ZONE UNITS*—Illustrated, 4 page engineering data sheet gives complete dimensional, specification information on company's multi-zone units. Line includes 12 sizes from 2500 to 34,800 cfm. Engineering drawing of unit also included. *Airfan Engineering Co., Dept. HPAC, 7401 Telegraph Rd., Los Angeles.*

▶ *PIPE INSULATION*—Recently released 10 page brochure describes "Snap-On" pipe insulation. Design, composition, applications discussed in text of publication, shown in diagrams and photos. Dimensions, spec-

RECENT TRADE LITERATURE

Continued

ifications of company's complete line given in series of tables. *Gustin-Bacon Mfg. Co., Dept. HPAC, 210 W. 10th St., Kansas City, Mo.*

▸ *PRESSURE-TEMPERATURE CARD*—Card has temperature scale extended to over 200 F with temperature range from −22 to 40 F in 1 deg increments. Card intended for air conditioning applications. *Advertising, Detroit Controls, Dept. HPAC, 5900 Trumbull, Detroit 8.*

▸ *REFLECTIVE INSULATION*—Illustrated, 24 page brochure provides thermal control information for architects, engineers, builders, contractors, building supply dealers. Specific properties of aluminum foil insulation, analysis of heat transfer problems, investigation of problem of preventing moisture damage resulting from condensation in walls and ceilings all covered in manual. Available at 10¢ each. *Reflectal Corp., Dept. HPAC, 200 S. Michigan Ave., Chicago 4.*

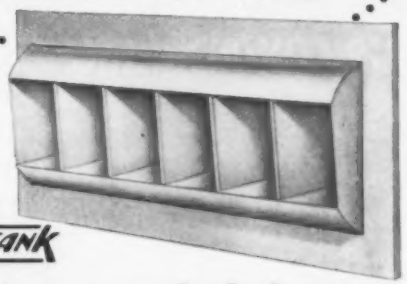
▸ *STAINLESS TUBING*—Folder "TDC-190" contains technical data on analyses, corrosion, oxidation resistance, high and low temperature characteristics, physical and mechanical properties of family of 18-8 stainless steels. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▸ *STEEL AND ALUMINUM DATA*—New edition of 256 page, pocket size "Data Book" includes aluminum analyses, characteristics, mechanical properties and tolerances in addition to previously published information on steel, including machining and fabricating data, manufacturing practices and tolerances, weights, safe loads, ASTM standards, compositions and properties. *Joseph T. Ryerson & Son, Inc., Dept. HPAC, Box 8000-A, Chicago 80.*

▸ *STORAGE RACKS*—An illustrated, 12 page bulletin and a brochure detail construction, specifications, dimensions, assembly of company's line of steel storage racks. Publications give information on installations for various applications. *Fabricated Materials Div., Acme Steel Co., Dept. HPAC, 135th St. and Perry Ave., Chicago 27.*

▸ *TANK, PIPE INSULATION*—New 4 page folder "FS-1" describes "Foamsil" insulating and refractory silica material, 99 percent pure fused silica. Material has practical operating range of −450 to 2200 F. Said to be unaffected by practically all commonly used acids and by thermal shock. Folder has list outlining physical characteristics of material with recommendations for uses. Available sizes, shapes also illustrated. *Pittsburgh Corning Corp., Dept. HPAC, One Gateway Center, Pittsburgh 22.*

FOR EXTREMELY LONG THROWS OF AIR IN LARGE AREAS OF ANY ENCLOSURE



THERMOTANK

drum type punkah louvres

Drum type punkah louvres originated by THERMOTANK engineers combine design and performance features that make them ideally suited for installation in large enclosures where extremely long throws are required.

THERMOTANK drum type punkah louvres are engineered to provide both horizontal and vertical control of the air stream. In addition, control of length of throw and its location is made possible by the rotating drum feature and adjustable vane design.

THERMOTANK drum type punkah louvres can be mounted in either a horizontal or vertical position without affecting the distribution of air from the outlet. This feature offers the architect and engineer unlimited application possibilities and does not restrict the location of the punkah louvres.

THERMOTANK drum type punkah louvres are highly recommended for installation in missile manufacturing plants, automobile assembly plants, aircraft plants, airport terminals, gymnasiums, arenas, in fact, any large enclosed area where air movement must be correctly distributed.

For complete engineering data on these punkah louvres, ask for catalog TA-150.

THERMOTANK — AGITAIR

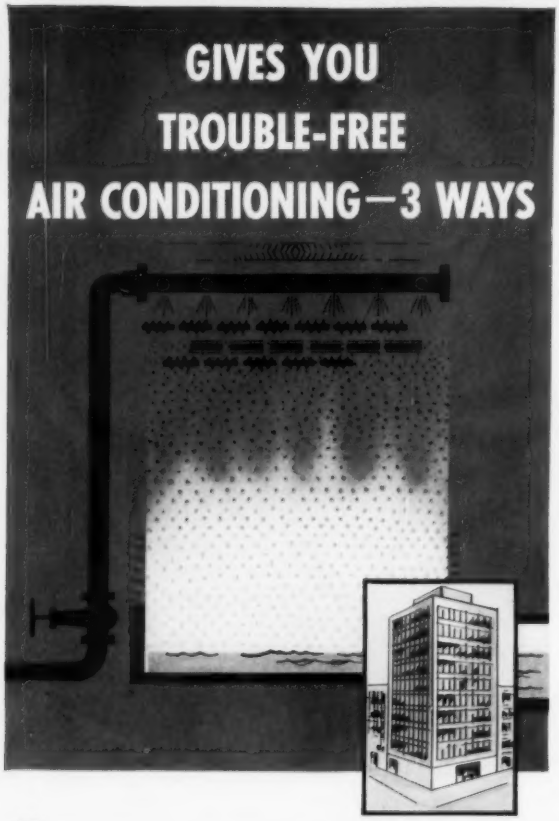
high velocity units • punkah louvres
air diffusers • filters • exhausters
registers and grilles

Sold exclusively by representatives for:

AIR DEVICES INC.

185 MADISON AVENUE, New York 16, N. Y.

Oakite Airefiner No. 52 in water

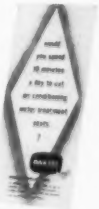


Properly treated water in air conditioning systems goes a long way in prolonging equipment life, improving operating efficiency and keeping systems trouble-free. A small amount of Oakite Airefiner No. 52 added to cooling tower water does all this—and more! A softening and purifying material, Airefiner No. 52:

1. **Checks growth of pipe-blocking, jet-clogging algae and slime**
2. **Prevents build-up of insulating scale**
3. **Minimizes metal-eating corrosion**

Try Oakite Airefiner No. 52 in your water system and see the difference in lower maintenance costs, more efficient cooling, less out-of-service time.

THIS MAINTENANCE MANUAL gives complete details on cleaning and maintaining air conditioning and refrigeration systems at less cost. For your free copy, write Oakite Products, Inc., 51B Rector Street, New York 6, N. Y.



SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

In our 50th year

Export Division Cable Address: Oakite
Technical Service Representatives in Principal Cities of U. S. and Canada

RECENT TRADE LITERATURE

Continued

▸ *VACUUM PUMP*—Bulletin "No. 97" gives complete details on company's line of portable vacuum pumps. Both single stage and two stage units available for use in dehydrating, testing refrigeration and air conditioning equipment in laboratory or field. Models available for 1, 2, 2.5 cfm capacities, operating on 110 volt lighting current. *Beach-Russ Co., Dept. HPAC, 420 Lexington Ave., New York* 17.

▸ *VALVES*—Bulletin "No. 9" defines applications of cast monel and nickel valves to corrosive environment. Respective areas of usefulness described, chemical and mechanical properties given. Basic designs illustrated. *Alloy Steel Products Co., Inc., Dept. HPAC, Linden, N. J.*

▸ *VALVES AND FITTINGS*—Illustrated 12 page catalog covers valves and fittings for piping and air conditioning applications. Dimensions, specifications, description and illustrations given for each item. *Cyrus Shank Co., Dept. HPAC, 4646 W. 12th Pl., Chicago.*

▸ *WATER CHILLERS*—Smaller size, reduced cost are features of "Model DE" packaged water chiller cited by manufacturer in 8 page catalog "No. 534." Units cover size range from 20 through 125 tons. Catalog includes description, performance data, specifications, dimensions. *Acme Industries, Inc., Dept. HPAC, 600 N. Mechanic St., Jackson, Mich.*

▸ *WATER TREATMENT*—"Technical Bulletin 589" gives complete details on "Hyzeen," new hydrazine products formulated for boiler feedwater treatment. Product is 35 percent aqueous solution of hydrazine nonflammable with neither flash nor fire point. *Betz Laboratories, Inc., Dept. HPAC, Gillingham & Worth Sts., Philadelphia* 24.

▸ *WELDING FITTINGS, FLANGES*—Technical bulletins "FDC-254," "FDC-257," "FDC-259," and "FDC-268" give dimensions, diagrams of company's welding fittings, forged steel flanges in 1, 2, 3, 16 in. sizes, respectively. Specifications given. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Milwaukee* 46.

▸ *WHAT AND WHY OF DRAFT*—The process of draft as it effects the efficiency of combustion together with details on various types of company's draft gages are given in 19 page bulletin "58-S201". Publication includes details on draft gages for measurement of low pressure, draft, differential. *Hays Corp., Dept. HPAC, 800 E. Eighth St., Michigan City* 14, *Ind.* ⫩

WHO'S WHAT . . .

(New personnel, promotions)

▸ *AIR REDUCTION SALES CO., DIV. of AIR REDUCTION CO., INC.*—R. E. Lenhard, president.

▸ *BOHN ALUMINUM & BRASS CORP.*—Simon D. Den Uyl, chairman of the board; Terry W. Kuhn, president; Richard C. Aylward, vice president, sales; H. Blake Thomas, vice president; Guy H. Pitts, elected to board of directors.

▸ *TOLEDO PIPE THREADING MACHINE CO.*—Norman J. Kirk, president and general manager.

▸ *NIAGARA BLOWER CO.*—Paul H. Schoepflin, chairman of the board of directors.

▸ *JOHNS-MANVILLE FIBER GLASS INC.*—Francis Hart May, Jr., vice president and general manager; Dominick Labino, vice president for research and development; Thomas A. Collins, vice president, operations planning.

▸ *CLAYTON MARK & CO.*—Clarence Mark, Jr., vice president and director, also named treasurer;

▸ *WESTINGHOUSE ELECTRIC CORP.*—Howard S. Kaltenborn, vice president and assistant to president; Dr. S. W. Herwald, manager of Air Arm Div. at Baltimore.

Harold Alwart, vice president in charge of engineering; Walter N. Matthias, named to new office of controller.

▸ *INGERSOLL-KALAMAZOO DIV. of BORG-WARNER CORP.*—Robert F. Schutz, executive vice president and manager of the division.

▸ *CHASE BRASS & COPPER CO.*—William H. Preston, executive vice president.

▸ *WEKSLER INSTRUMENTS CORP.*—Alvin Marks, executive vice president.

▸ *BABCOCK & WILCOX CO.*—Dr. Lauchlin M. Currie, vice president in charge of atomic energy division.

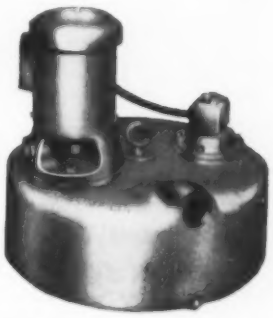
▸ *PITTSBURGH CORNING CORP.*—Robert E. Buckley, vice president in charge of sales.

▸ *RUBBER & ASBESTOS CORP.*—William A. Angus, vice president, sales.

As Simple as ABC

A COMPLETE UNIT

LOW RETURN
LOW SPEED
LOW WATER LINE



CAST IRON RECEIVER – for long life!

A RETURN

DISCHARGE B

C ELECTRICAL

A — One return line connection

B — One discharge line connection

C — One electrical connection

The TVC Condensate Pump is a low speed (1750 R.P.M.) pump for long life and trouble free service.

The unit is completely factory assembled for a simple A-B-C installation.

The low return connection and compactness of the unit provides for simple installation in all locations – particularly where space is limited.

DIMENSIONS

Single Unit—Cap. to 6000 sq. ft. E.D.R. 21" Dia. receiver; hgt. of return above floor only 6⅞".

Duplex Unit—Cap. to 10,000 sq. ft. E.D.R. 25½" Dia. receiver; hgt. of return above floor only 7⅜".

Duplex Unit—Cap. to 15,000 sq. ft. E.D.R. 25½" Dia. receiver; hgt. of return above floor only 10½".

Send for Bulletin TVC-300

CAPACITIES FROM 750 TO 15,000 SQ. FT. E.D.R. — PRESSURES TO 40 P.S.I.

weil PUMP COMPANY

Available from Jobber's Stocks!

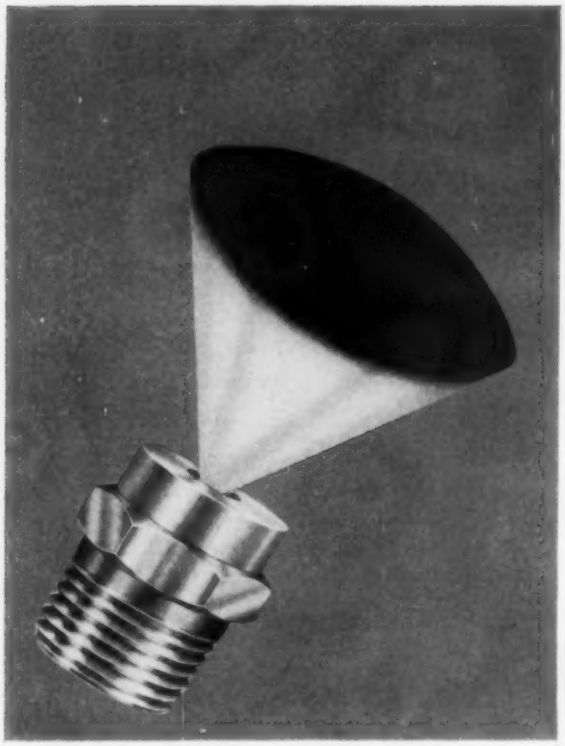
1514 N. Fremont St., Chicago 22

AIR CONDITIONING NOZZLE PROBLEM

To select a nozzle which will provide efficient water coverage to condensing coils

SOLUTION

Delavan Type SC nozzle



The extremely solid cone pattern delivered by the SC nozzle assures maximum heat transfer and minimum corrosion build-up on condensers. The SC provides excellent performance at low pressures. It is furnished with a hex body for easy installation and is available in a wide range of capacities, spray angles, pipe sizes and materials.

Whatever nozzles you require for air conditioning applications, there's a Delavan that does the job best. Write today for Catalog 33A.

DELAVAN *Manufacturing Company*

WEST DES MOINES, IOWA

WORLD'S LARGEST NOZZLE SPECIALIST

WHO'S WHAT *Continued*

▸ *CARRIER CORP.*—David W. Jasper, vice president and general counsel; Theodore Skoglund, manager of marketing services for the unitary equipment division; William L. Westlake, manager of the engineering services department of the unitary equipment division; Burton T. Kehoe, sales manager of packaged air conditioning equipment for the unitary equipment division; Arthur E. Meling, manager of technical services of the unitary equipment division.

▸ *DETROIT CONTROLS DIV. of AMERICAN RADIATOR AND STANDARD SANITARY CORP.*—F. G. Coggin, vice president; George F. Butterfield, general manager of manufacturing; William A. Miller, manager of marketing administration.

▸ *SQUARE D CO.*—Mitchell P. Karatalia, vice president.

▸ *ROBERTSHAW-FULTON CONTROLS CO.*—John C. C. Byrne, vice president, finance; Paul E. Cate, director of industrial and production engineering for the *FULTON SYLPHON DIV.*; Arnold C. Hansen, assistant to the general manager of *GRAYSON CONTROLS DIV.*

▸ *DETROIT STAMPING CO.*—William H. Roberts, executive vice president; Harry C. Robeson, vice president in charge of sales; Herbert McMillan, appointed sales manager of the stamping division; Charles Hoppe, sales manager of the finished products division.

▸ *MANNING, MAXWELL & MOORE, INC.*—John F. Reed and Arland R. Walkley, vice presidents.

▸ *YOUNGSTOWN SHEET AND TUBE CO.*—Robert P. Bremner, vice president, raw materials; Donald S. Day, vice president, traffic; Karl L. Fetters, vice president, research and development; James D. Sloan, vice president, purchasing; Richard J. Stamberger, manager of trade relations department; Robert W. Walling, assistant manager of "Yoloy" sales; Roy A. Curl, manager of sales promotion and advertising; Robert B. Davidson, assistant manager of "Yoloy" sales; Dean N. Frederickson, assistant manager of conduit sales; Herbert L. Furse, assistant manager of line pipe sales; Oscar H. Reuter, assistant manager of standard pipe sales; Robert K. Stephens, assistant manager of carbon bar, rod and wire sales; William H. Stokes, assistant manager of tin plate sales.

▸ *TUTHILL PUMP CO.*—Ernest H. Schanzlin, chief engineer.

WHO'S WHAT

Continued

▶ *H. K. PORTER CO., INC.*—Donald R. Miller, works manager of W-S Stainless Steel Works, Forge and Fittings Div.

▶ *MILWAUKEE VALVE CO., SUBS. of CONTROLS CO. OF AMERICA*—Donald A. Elert, sales manager.

▶ *CONTROLS CO. OF AMERICA*—Phil Bain, product line manager, industrial and commercial sales; H. R. Chapin, chief product engineer, appliance and automotive controls; J. J. Kaleba, engineering supervisor of switch group; Marshall Zugehar, sales coordinator, international division activities.

▶ *CHRYSLER CORP., AIRTEMP DIV.*—George H. Childers, manager of room air conditioner department; Sydney Anderson, Jr., manager of packaged equipment department; Robert E. Stotz, manager of applied machinery and systems department; Robert W. Forster, manager of business and market research; Warren Fitch, director of distribution.

▶ *DAYTON RUBBER CO.*—William O. Blandford, assistant to the merchandising manager.

▶ *BLAW-KNOX CO.*—Charles P. Grisell, manager of engineering and development for company's power piping and sprinkler division, appointed assistant director of Power Equipment Div., Business and Defense Services Administration, U.S. Dept. of Commerce.

▶ *A. M. BYERS CO.*—Gilbert R. Semans, chief steel metallurgist.

▶ *WHEEL TRUEING TOOL CO.*—Marian Szczepanski, director of research.

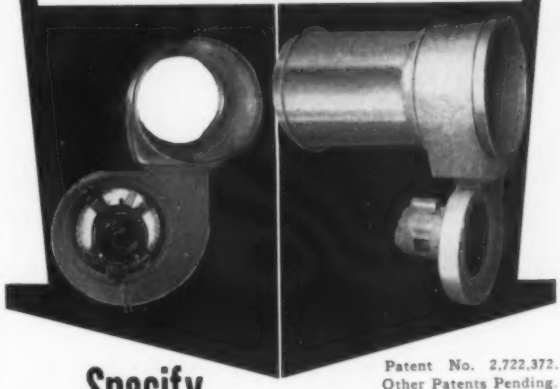
▶ *AMERICAN-STANDARD, PLUMBING AND HEATING DIV.*—Robert W. Williams, general marketing manager; Robert W. Prinslow, advertising and sales promotion manager.

▶ *HUDSON ENGINEERING CORP.*—Ennis C. Smith, elected secretary of *COOLING TOWER INSTITUTE.*

▶ *ARMCO STEEL CORP.*—M. E. Carruthers, director of stainless steel research; F. K. Bloom, manager of research laboratory at Baltimore works; M. W. Marshall, supervising metallurgist.

▶ *AIR-MAZE CORP.*—Ned Lamprecht, chief application engineer.

FOR LOW COST HEATING PLANT POWER-DRAFT AND INDUSTRIAL EXHAUSTING



Patent No. 2,722,372. Other Patents Pending.

...Specify

Quickdraft

★ NO MOTORS, FANS OR BEARINGS IN EXHAUST LINE ★ NEEDS NO STACKS ★ ACID RESISTING FINISHES ★ STATIC PRESSURE UP TO 60 INCHES

FOR HEATING PLANTS AND INCINERATORS, Quickdraft provides constant draft for efficient and economical combustion. It eliminates pulsating or chattering, puffing, smoking and sooting. Costly, tall and unsightly stacks are unnecessary.

FOR INDUSTRY, Quickdraft now offers from ¼-inch to 60-inches static pressure for exhausting corrosive gases, abrasives and paint spray . . . moving fine bulk materials and wastes.

FOR MOVING AIR . . . in or out of building through ducts . . . Quickdraft is outstanding.

N-648-QD

IMPORTANT NOTICE

For withstanding corrosive gases, all Quickdraft units are available in standard acid resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P.V.C.) and with plastic and Fiberglas coatings.

Write for QUICKDRAFT ENGINEERING DATA on your application . . . today.

Quickdraft P. O. Box 87-K
CORPORATION Canton 1, Ohio

Low cost and ease of installation permit wide usage.

NEW LOW-COST TAYLOR TEMPERATURE TRANSMISSION

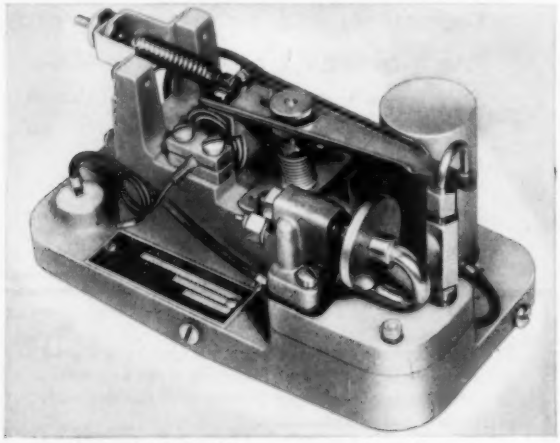
The new Taylor SENSAIRE* Temperature Transmitter provides low cost temperature measurement and pneumatic transmission to remote receivers and controllers, within limits of minus 30°F. to plus 1200°F. Simplified adjustments and excellent repeatability. Rugged, compact, force-balance, with mercury-filled system, it is self-compensating for ambient temperatures.

Four range spans available. A simple thumb-screw adjustment zero-sets the instrument within wide limits. Factory calibrated accuracy is well within 1% of rated range, below 550°F; 1½% above 550°F.

All SENSAIRE transmitters and components are interchangeable (regardless of range).

Write for SENSAIRE Bulletin 98293, or see your Taylor Field Engineer, Taylor Instrument Companies, Rochester 1, N. Y., or Toronto, Ontario.

*Trade-Mark



Operational simplicity in a rugged, compact unit.

Taylor Instruments

MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▸ *FLUOR PRODUCTS CO.*—James P. Wiseman, elected treasurer of Cooling Tower Institute.

▸ *AMANA REFRIGERATION, INC.*—Wes Brient, product manager of room air conditioner division.

IN THE TERRITORIES . . .

(Recent sales appointments)

▸ *CONTROLS CO. OF AMERICA*—New distributors for company's products: Milo Electronics Corp., New York; Burnstein-Applebee Co., Kansas City; Interstate Supply Co., St. Louis; Electronic Equipment Co., Brooklyn; Electro-Tech Equipment Co., New York; Enterprise Electric Co., Omaha; Srepco Inc., Dayton, Ohio; Adelphi Electronics, Mineola, N. Y.; Kann-Ellert Electronics, Inc., Baltimore, Md.; Newark Electric Co., Chicago; Edward F. Aymond, Inc., Dallas; Boenecke Associates, Camden, N. J.; Cartwright & Bean, Memphis; Grant Sales Co., Minneapolis; McDowell-Redlingshafer Sales Co., Kansas City; Jim Morrow Sales, Highland Park, Mich.; Bert C. Porter Co., Seattle; John G. Twist Co., Chicago; R. O. Whitesell & Associates, Indianapolis; Ash M. Wood Co., El Monte, Calif.; Frank Todino Sales Co., Needham, Mass.; Win Tompkins & Co., Palo Alto, Calif.; Jack V. Costello, Syracuse, N. Y.

▸ *POWERS REGULATOR CO.*—Eugene V. Bowles, manager of new branch office in Champaign, Ill.

▸ *SOLAR AIRCRAFT CO.*—Control Equipment Co., Inc., Atlanta, representative; T. J. O' Brien Engineering Co., Memphis, representative; H. M. Summerell Co., Richmond, Va., representative; O' Brien Equipment Co., St. Louis, representative.

▸ *SPORLAN VALVE CO.*—Hubbell Corp., Mundelein, Ill., distributors.

▸ *TRANE CO.*—Conditioned Air, Inc., Houston distributor.

▸ *GRABLER MFG. CO.*—Roy C. Klostermeyer, assistant manager of sales of central district with headquarters in Cleveland.

▸ *GRAVER WATER CONDITIONING CO., DIV. of UNION TANK CAR CO.*—Garth E. Pehrson, sales engineer for the Chicago district office.

WHO'S WHAT

Continued

▸ *AMERICAN AIR FILTER CO., INC.*—Air Systems, Inc., Detroit, sales representative; Ray Co., Dallas, sales representative.

▸ *WORTHINGTON CORP.*—Zone sales managers: H. Fleit and W. Souther, northeast zone; J. Klaiber, central zone; J. Wait, southeast zone; W. Dorsey, central west zone; E. Salaun, southwest zone; J. Winters, western zone; K. Blessing, northwest zone; H. A. Caldwell, eastern national account manager.

▸ *KALAMAZOO TANK & SILO CO.*—B. G. Russelo, sales engineer for the machine tool division in Michigan, Ohio, Pennsylvania and West Virginia.

▸ *MODINE MFG. CO.*—Weber-Rishel Co., Cincinnati, sales representative; Williams and Staup, Inc., Toledo, sales representative; Meacham Pump and Equipment Co., Springfield, Mass., territory.

▸ *ORR & SEMBOWER, INC.*—Bagwell Co., Tulsa, sales and service representative in state of Oklahoma.

▸ *PATTERSON-KELLEY CO., INC.*—Milwaukee district sales office moved to 4003 W. Capitol Dr., Milwaukee 16.

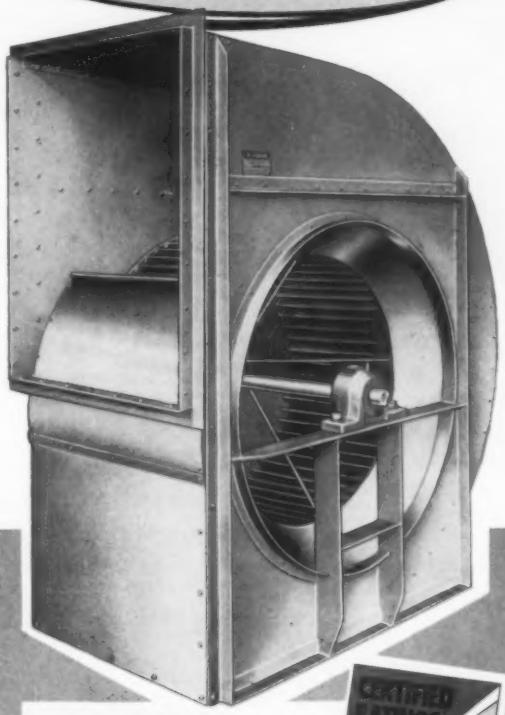
▸ *ARCOS CORP.*—Alfred Provencher, Chicago district manager; Carl Gage, New England district manager.

▸ *WOLVERINE TUBE, DIV. of CALUMET & HECLA, INC.*—R. B. Flynn, district sales manager of new Cleveland office at 3949 Lee Rd.; Carl T. Fuller, sales manager of southwestern district; Phillip MacKay, sales manager of Philadelphia district; George W. Overstreet, sales manager of Dallas district; Edmund J. Campbell, sales manager of Detroit district; T. F. Vigmostad, sales manager of St. Louis district; Richard C. Cash, sales manager of Birmingham, Ala., district; Fred F. Moore, sales manager of New York district.

▸ *UNITED STATES STEEL CORP.*—Louis W. Mason, sales manager, eastern area; James G. Morrison, sales manager, central area.

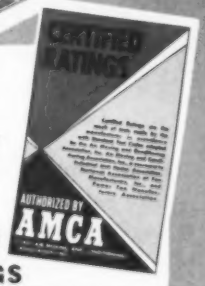
▸ *CARRIER CORP.*—Fontanesi & Kann Co., Detroit, sales representatives in southeastern half of Michigan Peninsula; Ner W. Rathbun, Grand Rapids, sales representative in southwestern half of Michigan Peninsula and some counties in northern Indiana, including city of South Bend.

Aladdin
AIR HANDLING EQUIPMENT



FANS *with built-in quality*

- EFFICIENT
- QUIET OPERATING
- CERTIFIED RATINGS



ALADDIN Series 94 Type FC Fans are available in 22 sizes both single and double width. These fans have been designed for the lowest rotational speeds consistant with high efficiency over the widest possible range of operating conditions.

Each fan is ruggedly built . . . fully equal to the job for which it is designed, and is backed by thirty-five years of know-how in manufacturing all types of air handling equipment.

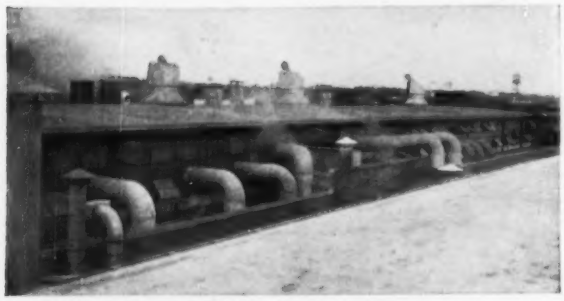
Write for complete data

ALADDIN HEATING CORPORATION

1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

A3

the downturn



and upturn at KVP

Same picture – different setting. Top shows complicated, space-wasting duct system which routed fumes back into plant for discharge through stacks. Bottom shows nine new 36" Aerovent "SP-7" Duct Fans installed to take fumes *up* and *out*, saving valuable floor space in busy working area. Just one of hundreds of successful Aerovent installations characterizing modern air engineering in action.

Write for free BULLETIN 400

All Aerovent Fans are rated in accordance with the Standard Test Code and U.S.D.C. Comm. Std. CS178-51.

Aerovent FANS

Aerovent

FAN COMPANY, INC.

ASH and BRANCH STS. • PIQUA, OHIO

Member Air-Moving and Conditioning Assn. (AMCA)

WHO'S WHAT *Continued*

▸ *CHRYSLER CORP., AIRTEMP DIV.*—Lawrence H. Baker, New York factory branch manager; Robert L. Williams, Houston factory branch manager.

▸ *MINE SAFETY APPLIANCE CO.*—Newly appointed sales engineers and their territories: John W. Moser, Kansas City, Mo.; Victor J. Elliot, Newark, N. J.; H. Duke Edwards, Philadelphia; Robert W. Swanson, Detroit; George T. Henderson, Los Angeles; Gerald E. Stackhouse, Buffalo, N. Y.; Eugene J. Condle, Pittsburgh.

▸ *PARKER-HANNIFIN CORP.*—J. N. Fauver Co., Inc., Cincinnati, franchised distributor.

▸ *PENNSALT CHEMICALS CORP.*—Merle G. Haynes, manufacturer's representative in nine state West Coast territory.

▸ *AMANA REFRIGERATION, INC.*—Julius C. Farley, Jr., regional sales manager, New York area.

▸ *BRISTOL CO.*—John F. Peterson, branch manager of Newark branch office.

▸ *HYNES ELECTRIC HEATING DIV., TURBINE EQUIPMENT CO.*—A. Q. Roberts, sales and service representative in northeastern Texas.

▸ *KEROTEST MFG. CO.*—SKB Co., Inc., Minneapolis, representative.

▸ *CLAYTON MARK & CO.*—James K. Cullinan, pump and well supply sales representative in Ohio, western Pennsylvania and eastern Kentucky; William Beavin, sales representative in Indiana and central Kentucky.

▸ *FARR CO.*—Eldon C. Thomas Co., Oklahoma City, sales representative.

▸ *TACO HEATERS, INC.*—R. M. Cotton Co., Minneapolis, distributor; Sales Engineers, Minneapolis, distributors.

▸ *WHITE-RODGERS CO.*—Paul H. Westphal, sales engineer in eastern Iowa and northern Illinois; Dick Krabbe, sales engineer in St. Louis and surrounding Missouri and Illinois counties.

▸ *COOPER ALLOY CORP.*—Gordon F. Ryan, salesman in state of New Jersey. ≠

WE HEAR THAT . . .

▸ The ownership of *JAMES P. MARSH CORP.* and subsidiaries has been acquired by *COLORADO OIL & GAS CORP.* of Denver. The company will continue to operate with identity, staff and sales representation unchanged.

▸ *NRC EQUIPMENT CORP.* has formed new engineering and sales groups to handle business in space testing facilities and products related to the nation's space program.

▸ *ROBERT G. WERDEN*, formerly general sales manager of *YORK CORP.*'s engineered machinery division has formed *VALLEY ENGINEERING CO.* at Glenside, Pa. The new company is a consulting engineering firm, specializing in the heat pump and electric heating field.

▸ An "Air Conditioning Clinic" developed and sponsored by *TRANE CO.* was initiated in Cicero, Ill., recently by the firm's Chicago sales office.

▸ *SPORLAN VALVE CO.* commemorated the 25th anniversary of its founding at a national sales meeting, January 5 to 9.

▸ *ARMSTRONG CORK CO.* has announced the establishment of a central market development and sales training department for its insulation division and building products divison.

▸ *BLAW-KNOX CO.* has announced that construction of a branch plant for its power and sprinkling piping division is underway at Jackson, Miss. The new facility, comprising a building with 17,000 sq ft of manufacturing space, will be constructed on a 15 acre site.

▸ *SETON NAME PLATE CO.* recently acquired additional equipment for the manufacture of pipe markers and valve identification tags. The acquisition is announced as a planned program of expansion.

▸ The board of directors of *TEXAS INSTRUMENTS, INC.* and *TEXAS METALS AND CONTROLS CORP.* announced that they had agreed in principle—subject to solution of regular and other matters—to recommend to their respective stockholders a merger of *TEXAS METALS & CONTROLS CORP.* into *TEXAS INSTRUMENTS, INC.*

Available NOW!

INDUSTRIAL VENTILATION MANUAL

- Revised equation for oven ventilation.
- New material on ventilation of radioactive and high-toxicity contaminants.
- 16 new hood designs, 33 revised hood designs.
- New material on air cleaning for radioactive contaminants.
- Revised equation for airflow into hoods.
- Revised table for collectors in industry.
- New chart on comparison of air filter characteristics.
- Revised, up-to-date table of maximum allowable concentrations.
- Revised table of physical constants.

Here's the biggest and most comprehensive Industrial Ventilation Manual yet—over 200 pages, containing more than 200 diagrams, 52 tables of ventilation material and 13 ventilation charts.

The Ventilation Manual contains all the information needed for the complete design of industrial ventilation systems. It is the official publication of the American Conference of Governmental Industrial Hygienists and is used as a basic text by leading universities. The recommended ventilation practices are approved by Federal, State and Municipal Government Industrial Hygiene Departments.

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Enclosed please find $_____ for _____ copies of the new 5th edition of the Industrial Ventilation Manual.

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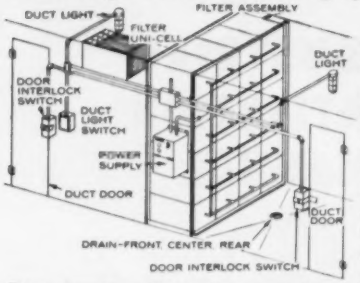
HARDBACK COPIES AVAILABLE AT $7.00 EACH

NEW HIGH VELOCITY ELECTRONIC AIR CLEANER

for removing dirt particles of sub-micronic size in ventilating and air conditioning systems.



This two-stage electrostatic air cleaner removes smoke, fumes and carbonaceous matter in particle sizes down to 1/100 micron. Handles 50% more air than conventional designs to conserve space and cost of installation. Dirt-cleaning efficiencies range from 85% to 90% at face velocities up to 600 fpm and up to 98% at lower face velocities.

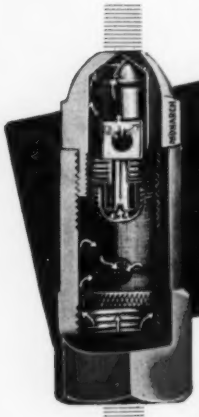
Employs ionizing section to charge air and dirt particles and separate plate section to collect oppositely charged particles which accounts for its high cleaning efficiency and high dirt-holding capacity.

Constant, low pressure drop inherent with this type of cleaner assures consistent rate of air flow to air conditioning systems.

Simple design, utilizing building block construction, eliminates cost and installation of holding frames. Uses selenium rectifier to eliminate need for vacuum tubes.

Provisions made for periodic cleaning with automatic, semi-automatic or manual washing.

Write for Catalog EMC-1055. **AIR-MAZE CORPORATION**, Cleveland 28, Ohio.



Monarch

NOZZLES For HUMIDIFYING

Monarch Brass F-80 Air Conditioning Nozzles (or ¼" male one-piece H-261 style) produce the finest possible breakup of small capacities with low direct pressure only. No air required.

The most popular size is #3.00 which operates on as little as 25 pounds pressure, delivers 1.00 gph and produces a very wide angle of spray (120°) in a fine, soft, fog-like mist.

Available in 25 different capacity sizes from .57 gph upwards, all Brass construction with 120 mesh Monel screen strainers.

WRITE FOR CATALOG I

Monarch MFG. WORKS, INC.
2523 E. ONTARIO ST.
PHILADELPHIA 34, PA.
Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

WE HEAR THAT

Continued

▶ *BURNHAM CORP.* has announced a change in the name of its plant in Belle Vernon, Pa., The plant, formerly known as the *BERGER FURNACE DIV.*, is now known as *BURNHAM CORP. WARM AIR & COOLING DIV.*

▶ *YOUNGSTOWN SHEET AND TUBE CO.* will expand its tinplate facilities next year to include a second new continuous line for its No. 2 Tin Mill, Indiana Harbor Works, East Chicago, Ind.

▶ U. S. headquarters of *KEE KLAMPS NORTH AMERICA LTD.* of Toronto, Ontario have been opened at 1079 William Street, Buffalo, N. Y.

▶ A new warehouse service center to serve Boston and greater New England area industry has been established under the name, *EUTECTIC WELDING ALLOYS, NEW ENGLAND DIV., INC.* It is located at 167 Brighton Ave., Boston.

▶ *W-K-M, DIV of ACF INDUSTRIES, INC.* has announced a new policy of appointing independent concerns as authorized repair shops for the company's line of through conduit gate valves. A service school has been set up at the factory for personnel of the new repair shops.

▶ Shareholders of *L. O. F. GLASS FIBERS CO.* voted to sell the firm's business and assets to *JOHNS-MANVILLE CORP.* The new company will be a wholly-owned subsidiary and will operate as *JOHNS-MANVILLE FIBER GLASS INC.*

▶ A new west coast plant of *CARLON PRODUCTS CORP.* has just been completed. The 35,000 sq ft facility is located at 250 E. Manville Rd., Compton, Calif.

▶ With its new electronic computing system, *BROWN FINTUBE CO.* is able to give overnight quotations on heat exchanger applications. The new system reduces the time required on heat exchanger designs to a few minutes.

▶ *DESOMATIC PRODUCTS, INC.* has purchased the goodwill, trademarks, engineering and production rights of *ANDERS LYKEN CORP.* New equipment will be produced under the combined trademark, *ANDERS-DRILINE.*

▶ *OAKITE PRODUCTS, INC.* celebrated its 50th anniversary of work in industrial cleaning materials and methods on February 2. ⧺

MEETINGS & CONVENTIONS

1959

FEB. 16-19—*Industrial Ventilation Conference*, eighth annual meeting. Kellogg Center for Continuing Education, Michigan State University, East Lansing, Mich.

MARCH 16-20—*National Association of Corrosion Engineers*, 1959 Corrosion Show and 15th annual conference. Sherman Hotel, Chicago. National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2.

MARCH 31-*APRIL* 2—*American Power Conference*, sponsored by Illinois Institute of Technology in cooperation with a group of technical societies and other educational institutions. Hotel Sherman, Chicago. Information: R. A. Budenholzer, Mechanical Engineering Dept., Illinois Institute of Technology, 3300 Federal St., Chicago 16.

APRIL 1-3—*Gas Appliance Manufacturers Association*, annual meeting. The Greenbrier, White Sulphur Springs, W. Va. GAMA headquarters: 60 E. 42nd St., New York 17.

APRIL 5-9—*Nuclear Congress*. Cleveland Auditorium, Cleveland. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

APRIL 28-*MAY* 1—*Mechanical Contractors Association of America*, 70th annual convention. Shoreham Hotel, Washington, D. C. Mechanical Contractors Association of America, 45 Rockefeller Plaza, Suite 570, New York 20.

APRIL 29-*May* 4—*Oil-Heat Institute of America, Inc.*, annual convention. Seattle, Wash. Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36.

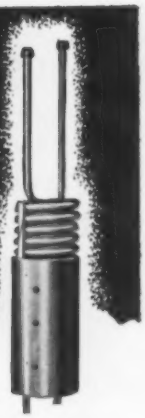
JUNE 1-4—*National District Heating Association*, 50th golden anniversary meeting. Skytop Club, Skytop, Pa. Information: John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6.

JUNE 7-11—*American Society of Heating and Air-Conditioning Engineers*, semi-annual meeting. Vancouver, B. C., Can. American Society of Heating and Air-Conditioning Engineers, 62 Worth St., New York.

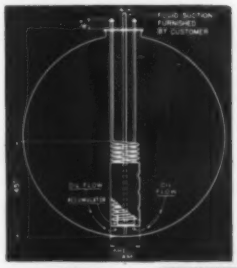
JUNE 22-24—*American Society of Refrigerating Engineers*, annual meeting. Lake Placid Club, Lake Placid, N. Y., American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1. ≠

The solution to
BULK TANK PREHEATING

REMPE "HOT SPOT" PREHEATER



Heats with either steam or hot water



Heats liquids in bulk storage to proper flow temperature, before they enter the suction pipe.

Special design "flow accumulator" causes liquids to pass over heated coils. Does the job efficiently and at low cost.

Construction — All-steel shell and coil assembly. Connections furnished for any diameter tank.

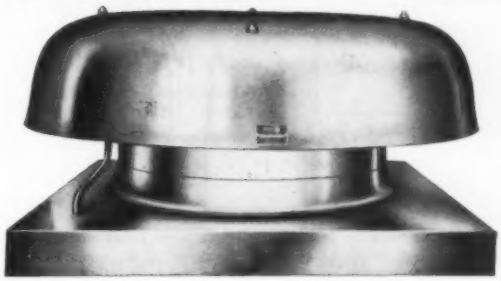
WRITE FOR BULLETIN

HEAT TRANSFER EQUIPMENT REMPE CO. Founded 1890

REMPE COMPANY

342 N. Sacramento Blvd., Chicago 12, Ill.

COOK Easy-to-install Aluminum ROOF VENTILATOR



Model QD—from 1200 to 38,350 CFM

Shipped completely assembled, with integral conduit to facilitate wiring. Direct drive fan has individually cast aluminum hub and blades. Blades are replaceable. Serviced from above the roof line. Extremely lightweight for size—38,350 cfm. unit weighs only 485 lbs. crated for shipping. Venturi type base and one-piece top cap are spun aluminum.

A complete line of spun aluminum centrifugal ventilators, belt and direct drive, is also available.

Write for catalog and free booklet "Ideas For Moving Air."

COOK VENTILATORS

LOREN COOK COMPANY
Berea, Ohio

this WALKER SHUR-FLO Draft Inducer-Regulator Unit...

ENDS DRAFT PROBLEMS RIGHT FROM THE START...

MODELS For Gas... Oil... and Solid Fuels!

THE INSIDE STORY OF SHUR-FLO EFFICIENCY

- Hi Volume Self-Feathering Fan
- Self-Cleaning Blades (No soot build-up)
- Stainless Steel Shaft, Hub and Blades.
- Quiet, burn-out proof motor
- Silicone oiled bearings
- Extra rigid mountings.
- Extra heavy gauge galv. steel construction.

"I don't fuss and fret with uncertain draft anymore since Walker brought out this low-priced draft inducer-regulator combination. Now, I install Walker inducers on all my jobs. That puts me way out ahead, because with good draft I know every job will be exactly right from the start."

"Most Efficient Draft System Ever Made"

Say Heating Contractors, Architects, Home Owners

Draft problems are eliminated with a Walker Shur-Flo Control (Pats. Pending) in an oil, coal, or gas-fired installation because it's the SUREST DRAFT SYSTEM ever devised.

Here's an economical draft inducer that's a fool-proof answer to every draft problem from older heating installations to modern, low-roofed houses. You just install it and forget it. What could be better?

Moreover, the Walker Shur-Flo with fan operated draft inducer moves ONLY flue gases; does not suck in outside air. Building and home owners like the Shur-Flo because it runs quietly, costs less to operate, and requires little power. You'll like the Shur-Flo because it installs quickly at any angle—vertically, horizontally, or at a pitch—and virtually eliminates costly callbacks and corrections.

There's a Walker Draft Control scientifically designed to meet every draft problem regardless of fuel. 28,000,000 in use prove efficiency. The standard of performance for the industry.

ROYAL PURPLE for smaller central heating plants

JUNIOR LINE central heating budget control

DOUBLE SWING for gas fired equipment

VENTURI CAP for heating and ventilating

For full details, see your supplier or write direct

WALKER MFG. AND SALES CORP. 1720 Penn St., St. Joseph, Mo.

NEW BOOKS & REPORTS...

AIR POLLUTION LABORATORY METHODS MANUAL. Los Angeles County Air Pollution Control District, 434 San Pedro St., Los Angeles 13. $12.50.

CONSTRUCTION ACCOUNTING AND FINANCIAL MANAGEMENT—By William E. Coombs. 481 pp. F. W. Dodge Corp., 119 W. 40th St., New York 18. $12.85.

FINE PARTICLE MEASUREMENT—By Clyde Orr, Jr. and J. M. DallaValle. 353 pp. The Macmillan Co., 60 Fifth Ave., New York 11. $10.50.

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FIELD INSPECTION OF BUILDING CONSTRUCTION—By Thomas H. McKaig. 352 pp. F. W. Dodge Corp., 119 W. 40th St., New York 18. $9.35.

THE UNFIRED PRESSURE VESSEL CODE SIMPLIFIED—By Robert Chuse. 46 pp. Robert Chuse, P. O. Box 91, Leonia, N. J. $6.50.

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WELDING TYPE 347 STAINLESS STEEL PIPING AND TUBING—By George E. Linnert. 103 pp. American Welding Society, 33 W. 39th St., New York 18. $3.50.

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WHAT IS A STANDARD?—American Standards Association, Dept. PR 34, 70 E. 45th St., New York 17.

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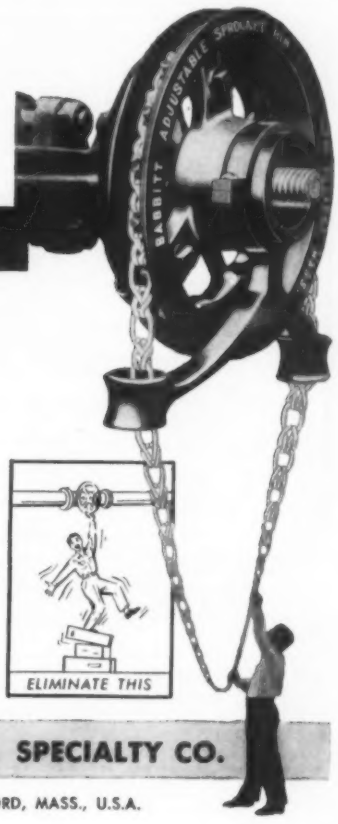

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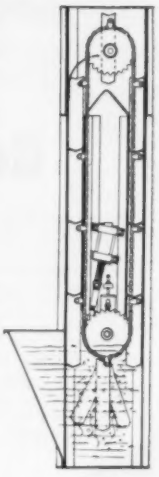

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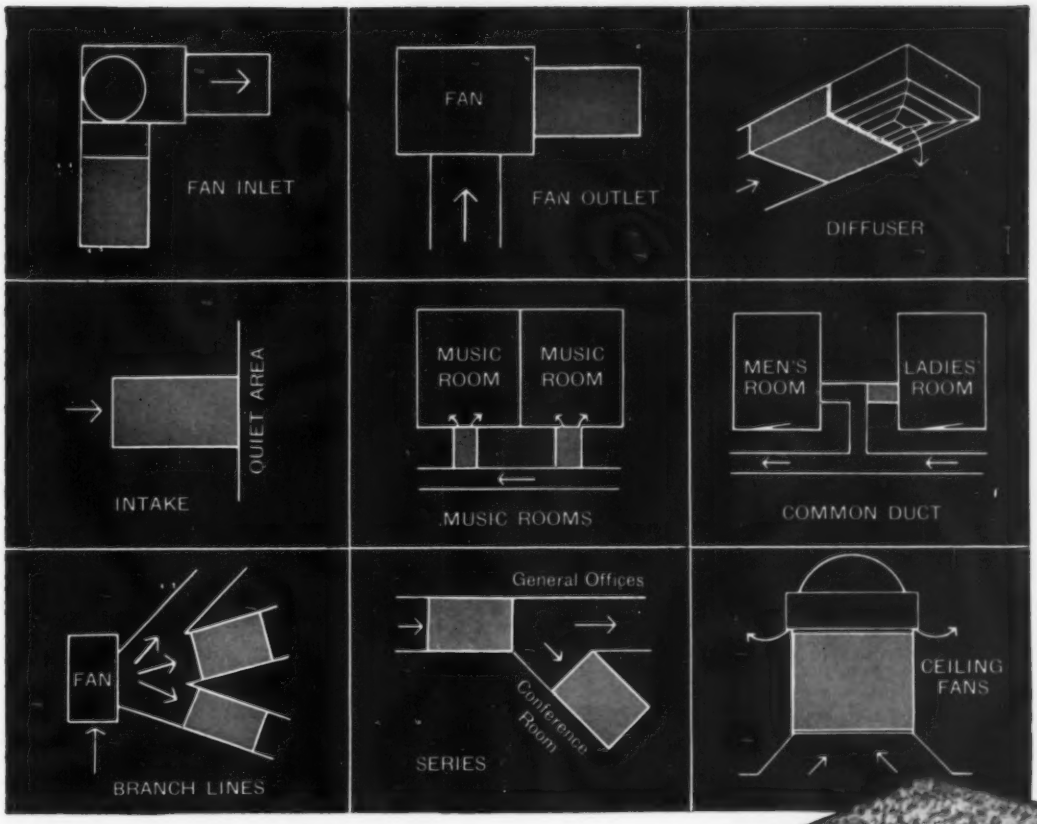

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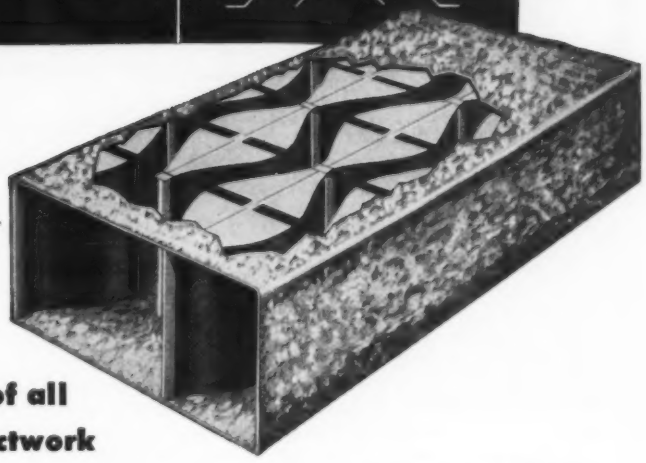

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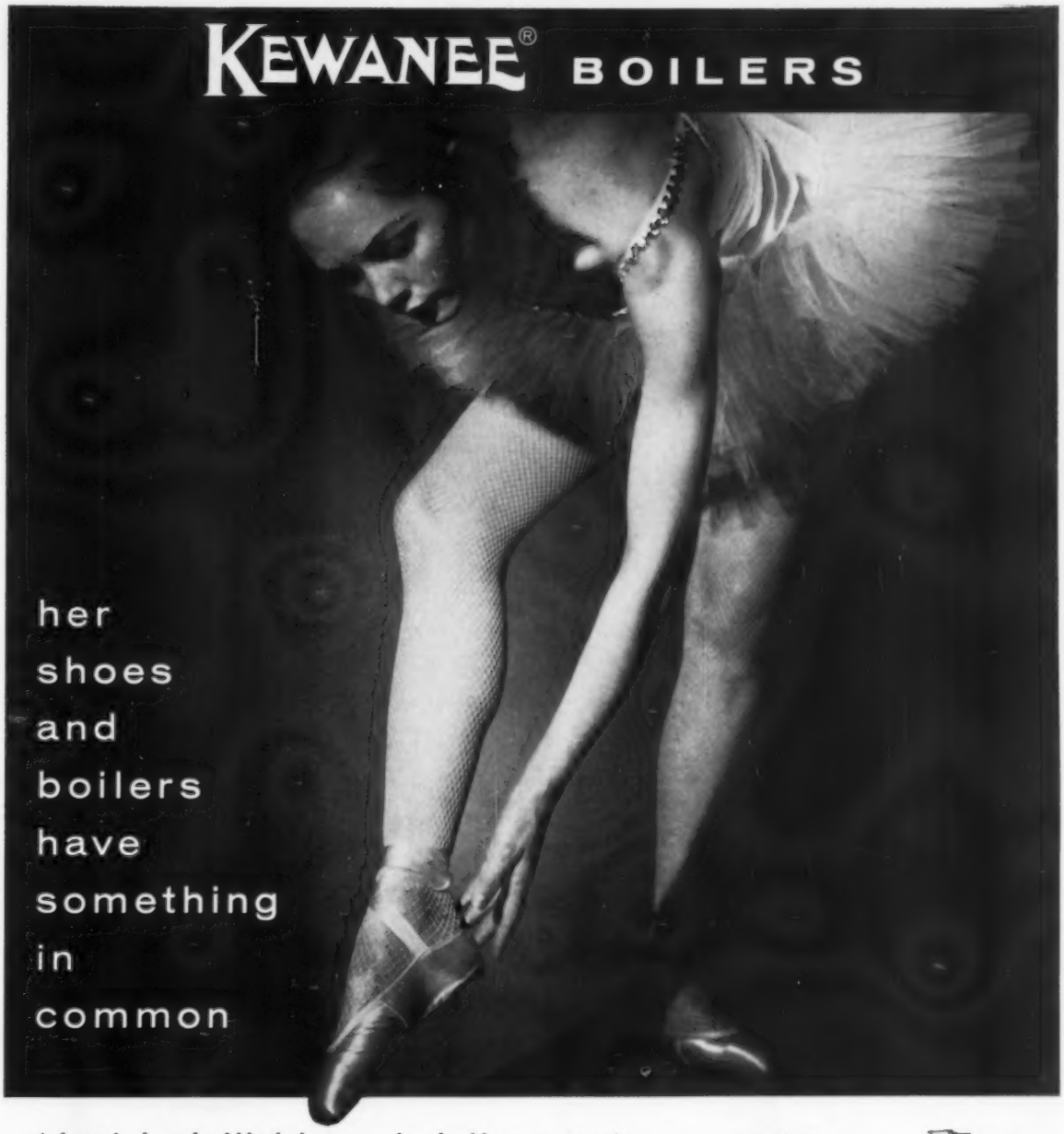

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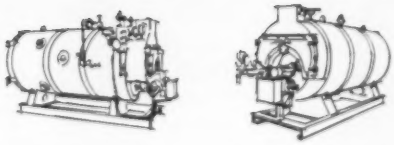

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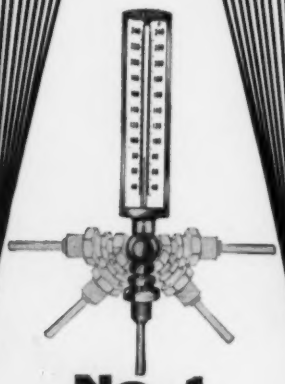

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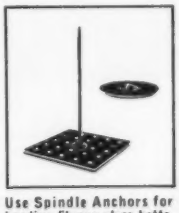

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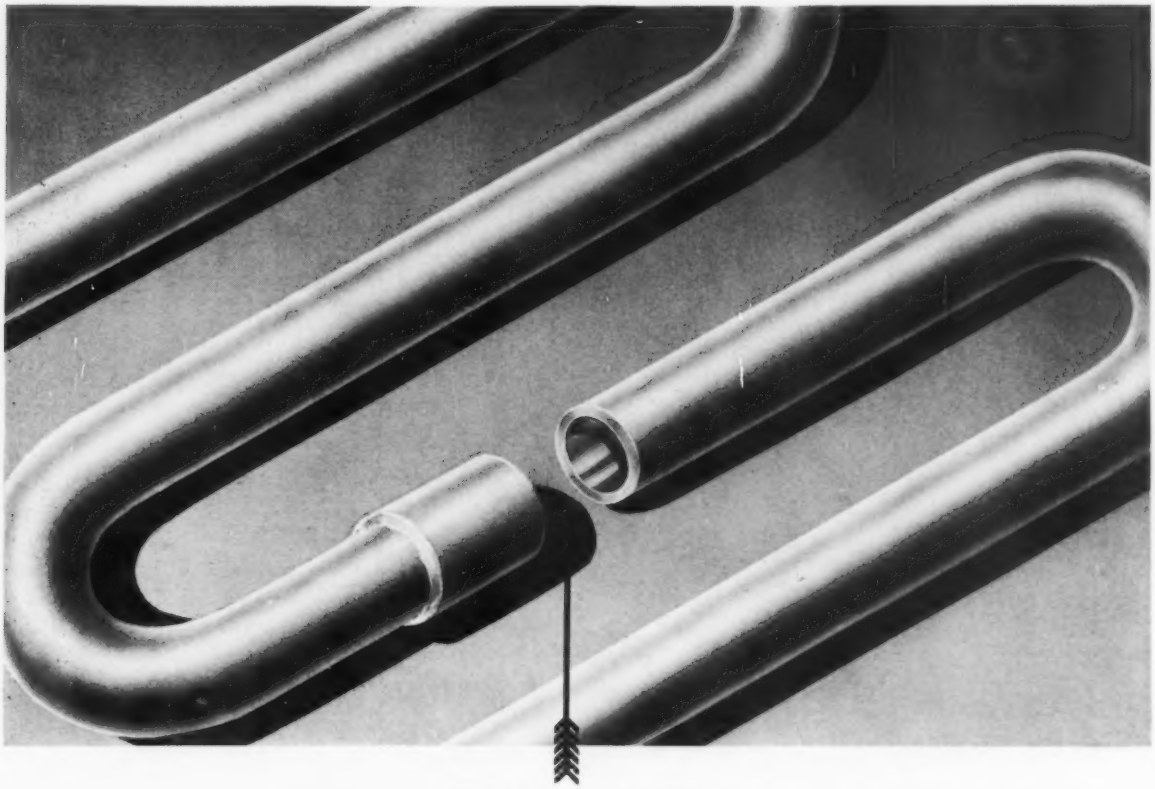

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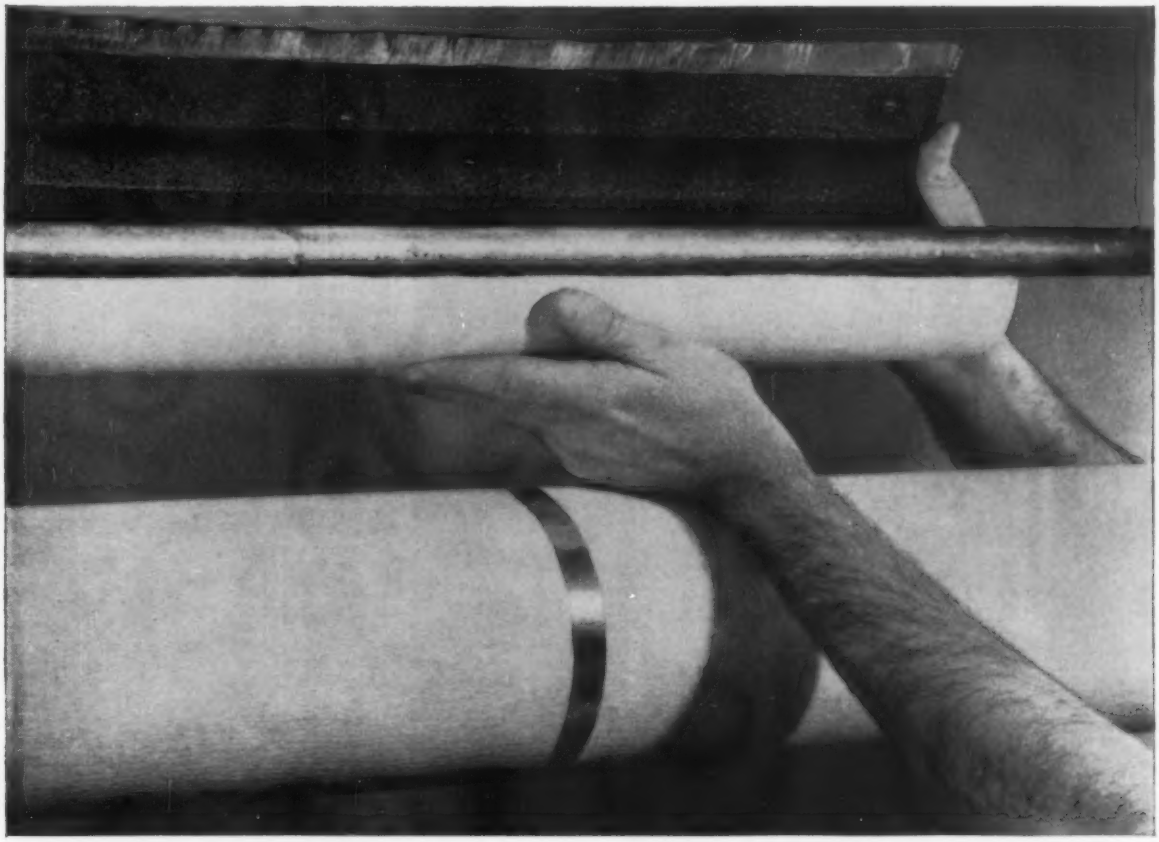

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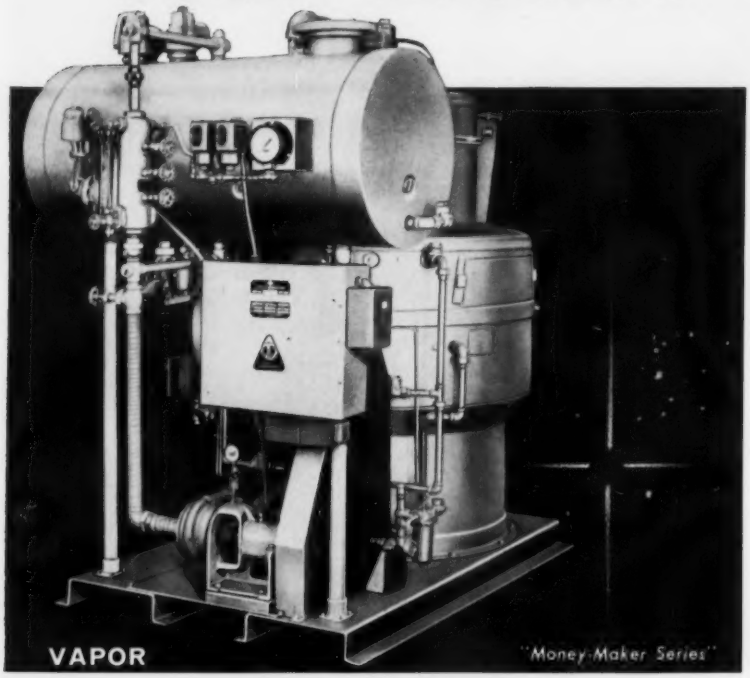

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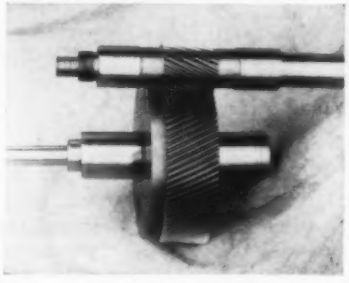

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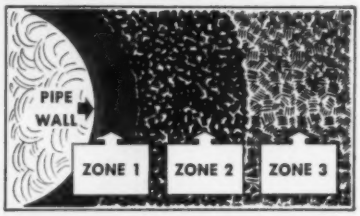

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Closely following this work, McDonnell & Miller developed the first of all Btu-rated relief valves. They were not only first into the field; they are still first. They not only conform to the letter of the code; they go beyond this: *introduce new standards of their own.*

For Hot Water Space Heating Boilers

McDonnell Valve No.	Boiler Size Btu./hr.	Opening Pressure	Inlet	Outlet
230-¾ IN.-30	303,000	30 lbs.	¾"	¾"
240-¾ IN.-30	513,000	30 lbs.	¾"	1"
230-1 IN.-30	743,400	30 lbs.	1"	1"
240-1 IN.-30	910,000	30 lbs.	1"	1¼"
230-1½ IN.-30	1,025,100	30 lbs.	1½"	1½"
240-1½ IN.-30	1,560,000	30 lbs.	1½"	2"
240M-3	2,313,000	30 lbs. 36 lbs.	2"	1" 2"
240M-4	2,710,000	30 lbs. 36 lbs.	2"	1¼" 2"
240-2 IN.-30*	3,130,000	30 lbs.	2"	2½"
240-2 IN.-36*	3,550,000	36 lbs.	2"	2½"

*Recommended installation: 36 lb. opening valve, with smaller auxiliary valve set at 30 lbs. for thermal expansion.

New Bulletin P-33 gives up-to-the-minute facts

- A new bulletin shows why and how the entire rated capacity of McDonnell Relief Valves is obtained without diaphragms or other auxiliary lifting devices.
- It shows how this operation—this operation so basic to safety—is ideally accomplished by using specially calibrated "low rate" springs, matched to disc area to give smooth precise lift and tight closure.
- It explains the widely adopted McDonnell principle of progressive settings that keeps discharge in step with function . . . small valve relieving normal expansion; large stand-by valve ready for the emergency.

These and many more significant facts are covered in the bulletin. Note the accompanying table listing a valve for practically every boiler—McDonnell quality straight across the board.

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